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TRANSACTIONS

OF THE

Seventh International Congress of Hygiene and Demography.

LONDON, AUGUST 10TH–17TH, 1891.

Patron:—HER MAJESTY THE QUEEN.

President:—H.R.H. THE PRINCE OF WALES, K.G.

VOLUME XI.

INDIAN HYGIENE AND DEMOGRAPHY.

EDITED BY C. E. SHELLY, M.A., M.D.,
Assisted by the HONORARY SECRETARY of the INDIAN COMMITTEE.

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INDIAN HYGIENE AND DEMOGRAPHY.

THE Contents of the first part of this Volume consist of papers and speeches contributed to the special Indian Meetings held on the 13th and 14th of August, 1891. Various papers also dealing with subjects more or less connected with Indian Hygiene and Demography were contributed to other Sections; these have been reprinted, and form the second part of the volume.

On the formation of the Indian Committee of the Congress in February 1891, Surgeon-General Sir W. J. Moore consented to prepare a comprehensive survey of sanitary progress in the Indian Empire; and for the consideration of this subject it was arranged to set apart one afternoon. Subsequently many offers of papers were received, and it was found necessary to devote two sittings to the discussion of the several important aspects of hygiene in India. Some of these papers could not be read, owing to want of time, but all are included in the first part of the present volume.

The decision arrived at by the Committee to invite the co-operation of "non-official India" as well as of "official India" marked a new departure; and the success of the experiment will, it may be hoped, lead to a similar course being followed in the future. For the result cannot fail to be fraught with benefit both to Europe and to Asia, and the proposal to establish a Tropical Section at future International Congresses of Hygiene and Demography appears to have given general satisfaction in India.

Not only were the Governments of all the Indian Presidencies and Provinces represented at the Congress, but numerous delegates attended from the Universities, the Chambers of Commerce, the leading Municipalities, and from influential native societies like the Poona Sarvajanik Sabha. The Secretary of State for India (Viscount Cross) and the Viceroy (the Marquess of Lansdowne) by their sympathy and support greatly facilitated the work of the organizers of the Congress.

One specially gratifying feature of the Indian Section was the liberality shown by many of the Native Princes. Among the principal contributors to the funds of the Congress were the Nizam of Hyderabad, the Gaekwar of Baroda, and the Marharajas of Mysore, Jeypore, Bhavnagar, Vizianagram, Travancore, and Cooch-Behar, all of whom were, with the approval of the President, H.R.H. the Prince of Wales, appointed Vice-Presidents of the Congress.

At the Closing Meeting of the Congress, held at the University of London on August 18th, under the Presidency of Sir Douglas Galton,

38709

K.C.B., the following Resolution was moved by Major-General Sir Owen Tudor Burne, K.C.S.I., C.I.E., M.I.C., and seconded by Surgeon-General Cornish, C.I.E. :—

"That the best thanks of the Congress be tendered to the Secretary of State for India and to the Viceroy of India for the interest which they have manifested in the Congress, and to Their Highnesses

The Gaekwar of Baroda, G.C.S.I.,
The Maharaja of Bhavnagar, G.C.S.I.,
The Maharaja of Cooch Behar, G.C.I.E.,
The Nizam of Hyderabad, G.C.S.I.,
The Maharaja of Jeypore, G.C.S.I.,
The Maharaja of Mysore, G.C.S.I.,
The Maharaja of Travancore, G.C.S.I.,
and
The Maharaja of Vizianagram, K.C.I.E.,

as well as to other Indian gentlemen, for the generous support which they have accorded to the Congress."

This Resolution, having been put to the Meeting, was carried by acclamation amid loud manifestations of approval.

S. Digby,
Hon. Secretary Indian Committee.

Seventh International Congress of Hygiene and Demography.

LONDON, AUGUST 10—17, 1891.

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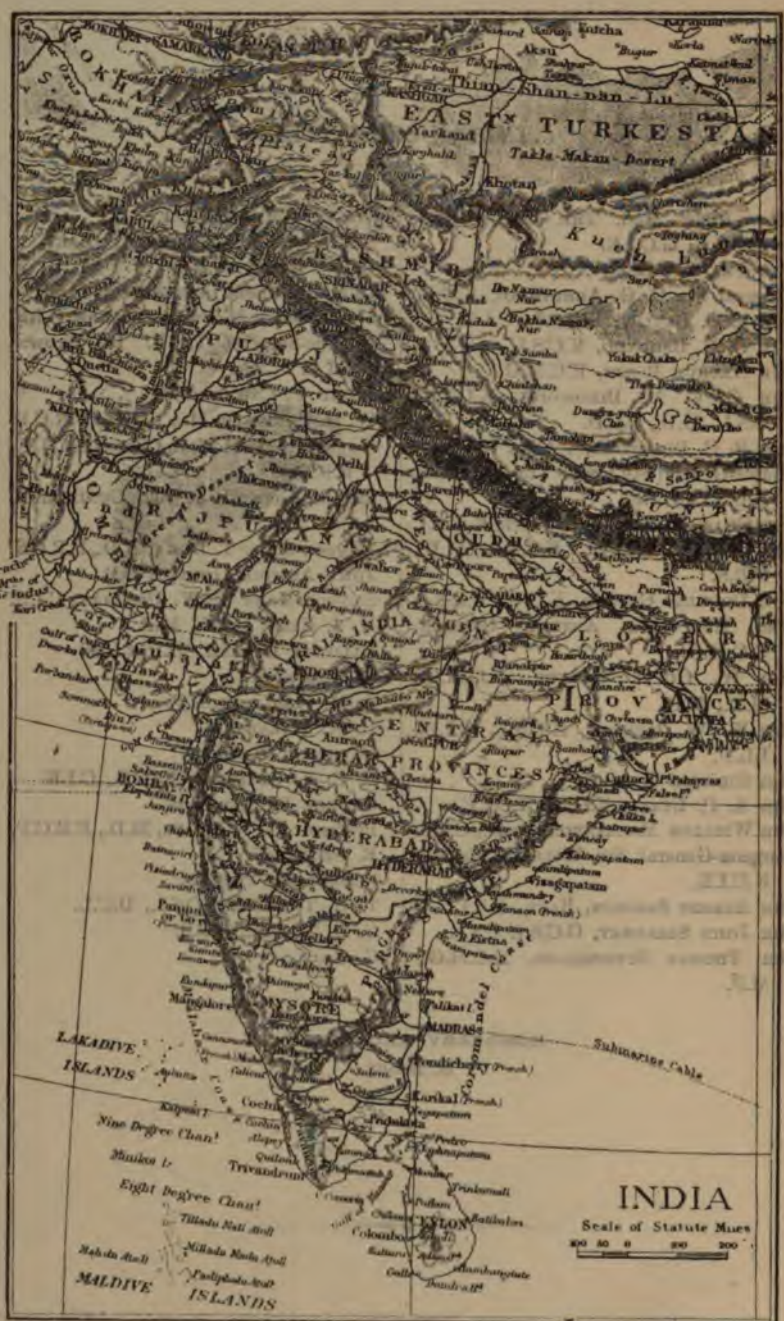
INDIA
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Thian-Shan-nan-Lu
Kuen Lun
Khotan
Yarkand
Aksu
Kutcha
Kashmir
Srinagar
Lahore
Delhi
Agra
Lucknow
Allahabad
Calcutta
Bombay
Karachi
Mouth of the Indus
Hyderabad
Madras
Mysore
Bangalore
Pondichery (French)
Karikal (French)
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Trivandrum
Colombo
CEYLON
Galle
Trincomali
Batticaloa
Jaffna
Pamban
Mandapam
Tuticorin
Cape Comorin
Coromandel Coast
Malabar Coast
Nagapatam
Vizagapatam
Masulipatam
Madras Presidency
Central Provinces
Bombay Presidency
Bengal Presidency
Rajputana
Central India
Oudh
Gwalior
Indore
Baroda
Kathiawar
Cutch
Sind
Punjab
Kashmir
Nepal
Bhutan
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Burma
Rangoon
Mandalay
Bhamo
Myitkyina
Tavoy
Mergui
Moulmein
Pegu
Prome
Bassein
Akyab
Kyaukpyu
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Tenasserim
Siam
Chiang Mai
Bangkok
Tonkin
Hanoi
Haiphong
Yunnan
Kunming
Tibet
Lhasa
Yarkand
Khotan
Kashgar
Aksu
Kutcha
Turfan
Hami
Urumchi
Kuldja
Tashkent
Samarkand
Bokhara
Khiva
Merv
Herat
Kabul
Peshawar
Quetta
Kandahar
Persian Gulf
Gulf of Oman
Gulf of Cutch
Gulf of Cambay
Gulf of Manaar
Palk Strait
Bay of Bengal
Arabian Sea
Indian Ocean
Laccadive Islands
Nine Degree Channel
Minicoy I.
Eight Degree Channel
Maldive Islands
Submarine Cable

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PROCEEDINGS

OF THE

INDIAN COMMITTEE.

INDIAN HYGIENE AND DEMOGRAPHY.

Thursday and Friday, August 13th and 14th, 1891.

The Right Honourable SIR MOUNTSTUART GRANT DUFF in the Chair.

The Chairman, in opening the meeting, said: In spite of the prescriptions of custom, it is not my intention to delay the more important part of our proceedings by a long speech upon subjects on which the views of specialists, and of specialists alone, are worth listening to. I have come here at the request of your organising committee chiefly to express the obligations under which those who have of late years presided over Indian Governments have felt themselves towards a body of officers who have not only with exemplary assiduity collected and recorded the facts which bear upon life and health in India, but have drawn from those facts conclusions upon which are based all fruitful administrative action in connexion with medical and sanitary subjects.

We look forward to-day to listening to a paper by Sir William Moore, late Surgeon-General with the Government of Bombay, for whom I know the late Governor of that Presidency has a very great respect. I have seen two or three other papers by gentlemen from Western India, which are, I believe, also to be submitted to you. I trust that the portion of India with which I have been more especially connected (Madras) will also be represented in this room by more than one able officer. Certainly no part of the country has had a more remarkable succession of distinguished men in its medical service. First come those whose chief task was to observe and to record their observations. I may select from a long bead-roll the great name of Dr. William Roxburghe, who had worthy successors in Dr. Heyne, in Dr. Berry—who gave his name to the Berrya Ammonilla—and in Dr. Wight, whose fame is written all over the Flora of the Nilgiris. Sir Whitelaw Ainslie's book, "The Materia Indica," though nearly 80 years have passed since he left the East, is still I believe, considered a valuable treatise. Then came the men whose chief duty it was to bring the conclusions of science to the assistance of the Administration in trying to improve the conditions of both European and Native life. Dr. Macpherson wrote a book of importance on Mountain and Marine Sanatoria, besides serving on the Sanitary Commission. Dr. Furnell,

who long presided over South Indian sanitation, had, even as a student, signalized himself by making a discovery with respect to the action of chloroform, which in the hands of others became of colossal importance. Dr. Cornish and Dr. Bidie, who happily are both alive, have done quite admirable service, the first, in connexion with the Madras Census of 1881, with the Local Government Acts now in force in South India, and with many other subjects; the second not only as a great reformer in things sanitary, but as a sort of universal referee on all matters scientific which approach the confines of medical knowledge, and on many which do not. I think, too, I may claim for Southern India, that persons serving there, many years ago, originated the movement for bringing the services of highly trained women to the assistance of their Native sisters, a movement which led to the establishment in Madras of the Victoria Caste Hospital, and which, having been taken up by the wife of the last Viceroy, is now being extended to all portions of our Eastern Empire.

The history of the Indian medical services is so creditable that I am sure that no Indian Governor or Lieutenant-Governor could address you without being able to record a great number of eminent names in connexion with the province in which his lot was cast. I speak of Southern India, not as wishing to put forward any undue claims for it, but because I happen to know most about it. Medical and sanitary reform in that part of the Peninsula will receive an immense impulse when the most intelligent section of the population, the Brahmins, take to medical study. They were beginning to do so a little when I left the country, and I have since heard that dissection is slowly and gradually losing its terrors for them. I remember thinking that one of the next changes that was required in our system was the appointment of a sanitary engineer to advise the local authorities. I do not know whether that has been done since my government came to an end. Very shortly before it did so, an order was issued approving a proposal made by Dr. Bidie in the following paragraph: "To render the town population healthier, "the Sanitary Department must for years to come carry on an "unceasing crusade against over-crowding, as well as against other "sanitary evils; and I think that a better understanding as to what has "been done would be attained if a systematic sanitary survey of all the "chief towns were carried out. Instead of a Sanitary Commissioner, "as at present, being required to visit and casually inspect a number of "places in the course of the year, it would be better for some time to "come if he made a thorough survey of a few towns annually, noting in "detail all their defects and requirements. This plan was found very "effectual in the earlier days of the Sanitary Department in the case of "military cantonments, and would be equally valuable with respect to "towns." That seemed to me a peculiarly happy suggestion, and I trust it has been acted on. We made, in my time, the civil surgeon of each district a sanitary officer, and imposed upon him the duty of advising the presidents of municipalities and local fund boards in everything that relates to medical and sanitary affairs; providing him at the same time with a second in command to undertake some of his former

duties. I hope that change is working well. Street conservancy, it appeared to me, had advanced pretty far in our larger towns, and the more intelligent natives were beginning to understand something about the importance of a pure water-supply. I am afraid, however, that there is a very great deal still to be done to improve the sanitary condition of the private dwellings in almost every town, to say nothing of country villages. I have here a letter from a lady for whom all Englishmen and Englishwomen have the most profound respect and affection, I mean Miss Florence Nightingale, in which she urges that prominence should be given on this occasion to village sanitation in India.

Governments should, I think, do all that in them lies to promote sanitary improvement, but "Quid leges sine moribus?" What can be effected till, in matters so closely connected with private life, they get public opinion upon their side? Light is penetrating; reforms are being made; but decades, nay generations, will pass before we can arrive at a state of things when we can with propriety, rest and be thankful. What do I say—that time will never arrive? The greatest of modern poets spoke a parable to all rulers when he made the angels who are carrying away the immortal part of Faust sing:—

"Who, ever striving, exerts himself,
Him can we redeem."

Having made these few preliminary observations, I now give place to those to whom we have all come to listen.

Sanitary Progress in India.

BY

Surgeon-General Sir WILLIAM MOORE, K.C.I.E., Q.H.P., Delegate from the Province of Bombay.

Previous to the transfer of British India from the Hon. East India Company to the Crown (1858), sanitation, as now practised there, was not even initiated. But following on this transfer, and the consequent more direct attention of the British public to India, the sanitary movement then in progress in England was, by various earnest reformers, urgently demanded for India.

The first step consisted in the appointment of a Royal Commission of inquiry into the sanitary condition of the Army in India, whose report was published in 1863. The announcement of the Commission that the death-rate of European soldiers in India averaged 69 per 1,000 annually, was received with astonishment and indignation. It was said in the House of Commons that this report had disclosed a state of things which no one had believed to exist. Yet that statement ought not to have been possible, because previous to the appearance of the Commission's report there had passed through the press such works

as Colonel Sykes' "Statistical Tables"; Macpherson's "Statistics"; Ewarts' "Vital Statistics of the Anglo-Indian Armies"; Chevers, "On the Means of Preserving the Health of the European Soldier in India"; and my "Health in the Tropics; or Sanitary Art applied to Europeans in India"; all reiterating the fact of Europeans *disappearing* at the rate of 69 per 1,000.

The mortality of the civil population at this period has been estimated at 35 per 1,000 annually. This however is conjecture, as there are no means of ascertaining what the death ratio really was. But I believe that the death-rate was considerably higher. The only information I can find on the subject relates to Calcutta alone, and consists in a calculation made by Macpherson in 1860, that the mortality of Calcutta averaged, from the year 1841, 39 per 1,000 annually; an estimate by Duncan, stating that for the four years ending 1835 the death-rate was 60 per 1,000; and one by Finch for the 12 years ending 1832, who supposed the rate to be upwards of 90 per 1,000.

In accordance with the recommendations of the Commission, a local sanitary committee was appointed for each Presidency, consisting of three members and a secretary. They were to consider, and to afford advice and assistance in all matters relating to, the health and welfare of the Army; and to supervise the gradual introduction of sanitary improvements in British stations, as well as in towns in proximity to military cantonments. They were also to prepare a Code of Sanitary Regulations. But India is a vast country extending over several degrees of latitude at various altitudes, ranging from the inundated plains and deltas of great rivers to the table land of the Deccan and the heights of the Himalayas; and it comprises (not counting Native States) 12 distinct and different Governments or Administrations. It was therefore soon found that a committee was too cumbrous and could not move freely about, so there was substituted one sanitary commissioner, a civilian, with a secretary. But it also soon became apparent that sanitation could not be separated from an acquaintance with the ætiology and nomenclature of disease. Selected medical officers were therefore appointed as sanitary commissioners. Moreover it was found necessary that each Government should have its special sanitary official; and about the year 1866 such nominations were made. In determining the nature of the duties to be performed by the new sanitary commissioners the Government of India proceeded a step further, announcing that the posts had been created solely for the purpose of improving the sanitary condition of the people. About 1874–75 the Vaccination Department, previously separated, was made over to the Sanitary Department, and vaccinators were to receive instruction in sanitary matters, so as to render them competent to point out and advise on sanitary defects during their progress through the villages. This however was not a success; for although exceptional instances may be found, the class of men employed as vaccinators appeared to lack the special qualifications for understanding or appreciating sanitation.

In Bombay the vaccinators are not required to assist in sanitary work. In the Punjaub they were for a time thus employed. In the Central Provinces it appeared undesirable to continue their work in this capacity. In Rajpootana they are instructed in the elements of sanitation, and do what they can with regard to the improvement of villages. In Madras the deputy inspectors of vaccination, 53 in number, report on the sanitary condition of towns and villages. In Berar the superintendents of vaccination are required to check the registration of births and deaths, and to notice briefly in their weekly diaries the sanitary condition of villages visited by them. In Coorg they assist to a slight extent. In the North-West Provinces and Oude, they assist "on special occasions; and they assist in giving "medical relief during epidemics."

At a comparatively recent date it was suggested* that there should be associated with the sanitary commissioner a member of the board of revenue and a sanitary engineer, to constitute a committee having extended executive powers. This has been accomplished for Bengal, the Punjaub, the Central Provinces, and Madras; and a sanitary engineer was appointed for Bombay, whose services are at the disposal of municipalities applying for them.

It should also be mentioned that sanitary projects and proceedings in India have been most advantageously advised upon by the Army Sanitary Commission in England.

I have here a statement showing the number of officials employed on sanitary work in India. But with reference to this statement it must also be recollected, that every civil surgeon in India advises on the sanitary condition of the locality in which his duties lie, and that some of the municipalities have employed health officers of their own.

At the onset it was felt that no real progress could be made unless the assistance of the people themselves was secured. It was further considered desirable that municipalities should form the centres from which education in sanitary matters should emanate. The first step was, therefore, the establishment of municipalities. A special Municipal Act was passed for the Presidency capitals about the year 1863, and soon afterwards another Act was passed for provincial towns. Still more recently legislation has endowed these bodies with considerable powers for securing the sanitary improvement of towns and villages, and has placed at their disposal much money for expenditure on that object.

Before 1871–72 expenditure was centralised in the Supreme Government, and grants were made to local governments on detailed estimates showing the need of each department. Local Governments asked as much, and the Supreme Government gave as little as possible; but certain heads of expenditure, including sanitation, were now transferred to local governments, with fixed annual grants to meet them.

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* Despatch from the Secretary of State, Januar 1889, forwarding a sanitary memorandum by Colonel Yule, C.B.

TABLE I.—SHOWING the PRESENT STRENGTH of the SANITARY DEPARTMENT in INDIA, 1891.

PROVINCES.	Date of Institution of Office of the Sanitary Commissioner.	Amalgamation with the Vaccination Department.	Staff.						Vaccination Staff, including all Classes.	Connexion with Military Sanitation.	Remarks.
			Sanitary Commissioners.	Deputy Sanitary Commissioners.	Sanitary Engineers.	Health Officers.	Port Officers.	Office Establishment.			
BENGAL - -	1868	1880	1	6	1	1	1	21	2,899	Nothing to do with military sanitation.	Health officer, and port officer for city and port of Calcutta.
MADRAS - -	1869	1869	1	1	1	1	—	—	864	Sanitary questions connected with the army are referred to the Sanitary Commissioner.	Health officer for city of Madras.
BOMBAY - -	1867	1876	1	5	1	1	2	63	594	Ditto - -	Health officer for Bombay, port officers for Bombay and Kurrachee.
NORTH-WEST PROVINCES AND OUDE.	1868	1868	1	3	—	—	—	—	760	Has nothing to do with military sanitation.	—
PUNJAUB - -	1868	1868	1	1	1	—	—	11	334	Ditto.	—
CENTRAL PROVINCES	1868	1868	1	—	1	—	—	—	262	Ditto - -	Sanitary Commissioner is also Deputy Surgeon-General controlling civil medical institutions.
BERAR - -	1868	1868	1	—	—	—	—	7	57	Ditto.	—
ASSAM - - -	1877	1877	1	—	—	—	—	—	141	Controls military sanitation.	Sanitary officer is also Deputy Surgeon-General in both civil and military departments.
COORG - -	1882	1882	1	—	—	—	—	—	9	Is civil surgeon and sanitary officer.	—
BRITISH RAJPOOTANA	1870	1870	1	—	—	—	—	6	13	Controls military sanitation of local corps.	Is surgeon to the Rajpootana Political Agency, with administrative control of civil medical institutions.
BURMAH - -	1872	1872	1	—	—	—	1	8	86	Nothing to do with military sanitation.	Is also Inspector-General of Jails. Port officer for Rangoon.
WITH THE GOVERNMENT OF INDIA.	1864	—	1	—	—	—	—	—	—	—	Advises the Government of India on both civil and military sanitation.
TOTALS - -	—	—	12	16	5	3	4	—	6,001		

In connexion with local self-government by municipalities, it should be stated that the latter were relieved in 1882–83 of police charges; the intention of the concession being that more should be spent on sanitation and improvements. Government have also granted loans to some municipalities.

According to the most recent reports, I find there are some 755 municipal towns in India, not including the large number of small villages where there are only sanitary boards; but the people living under municipal control comprise only 5 per cent. of the total population.

The total receipts of all the municipalities for the year 1889–90 was Rs. 3,720,000, including Rs. 806,000 from loans. About 45 per cent. of this was spent on sanitation. The income is derived from house tax, tax on rentals, octroi duties, bazaar-stall rents, wheel tax, water rates, rents of properties, public garden and park fees. The population of the municipal towns was 14,275,858. There are also numerous district and local boards for the administration of district hospitals, dispensaries, schools, roads, &c. The importance of the work done by all these local bodies may be estimated by the facts that they have at their disposal, according to the last "Moral and Material Progress Report" of India, more than 7,000,000*l.* sterling annually.

The "Times of India" has recently observed:—

"In a sound and healthy state of society no 'globe-trotter' would be permitted to print a book on India unless he had passed an examination on this report. It might strike his mind as a significant fact that the first chapter, recording the administration of the bureaucratic and despotic Indian Government, is devoted to local self-government. The difference between the Government of England and the Government of Moghuls ought to be brought home to him by the following sentence: 'In every province of India a good deal of local business is done, considerable funds are raised and spent, and valuable service performed for the public by local bodies.' In a land which for centuries was a prey of anarchy and misrule, we now read: 'The cities and large towns manage their own local affairs through the agency of commissioners or committees appointed among the citizens.' A Russian official would be surprised by the following passage: 'On almost every municipal body one or more Government officials sit as members, but the number of Indian and non-official members everywhere exceeds the number of Europeans and officials.' The introduction of local self-government was a doubtful experiment. It was, however, wise to carry it out honestly, and it has, on the whole, proved a success."

It must be confessed, however, that Government has sometimes occasion to exert a little wholesome pressure on municipalities as regards drainage and water-supply, as is evident by the following quotation from the "Times of India" of the 5th of June last:—

"The municipality of Cawnpoor who threw out the other day the water and drainage scheme which had been officially prepared for them,

and substituted something very different of their own, have just been dealt with in a resolution in the 'Provincial Gazette.' The greater part of the resolution is, in fact, a justification of Government policy in the eyes of the public at large, demonstrating how well able the different municipalities are to meet the small increase of expenditure on these works that the liberality of Government has left upon their shoulders. As for the Cawnpoor board, it is informed that the Government cannot possibly accept the alternative it proposes, which is described as waiting to watch the effect of repairing a few sewers, recasting a few surface drains, and cleaning out a few wells. The duty of Government is to see that the public health is not sacrificed, and, failing proof on the part of the board that it is financially incapable of prosecuting the scheme, or the production of a better one, the Government at the close of the year will take the matter into its own hands."

Although ordinary sanitary measures may be summed up as improved water supply, removal of filth, surface and subsoil drainage, public health cannot be separated from material and moral progress. For as the latter advance, sanitation will proceed. I, therefore, mention several subjects which, although not coming directly under the head of "sanitation," are really most instrumental in promoting the public health.

First, there is improvement in the food supply of the people. In a country like India, where failure of the rains, inundations, cyclones, or locusts, often wholly or partially prevent crops coming to maturity, increase of food supply and facilities for distribution are vitally important. For all the diseases of India, especially fevers, bowel complaints, and cholera are most prevalent and destructive among a badly fed people. The food supply has been increased by the attention and encouragement given to agriculture by model farms, shows, fairs, prizes, &c. The weakest point in native agriculture was the deficient use of manure, principally because the Indians objected to use human ordure or sewage, an antipathy which has been overcome in many localities, although it still prevails in others.

Next, so far back as 1869, the Government of Lord Mayo decided that an attempt should be made to further utilise fish as food. In Canara, out of a population of 839,688, it was found that 760,160 were fish-eaters. In Orissa fish is universally eaten, also largely in Bengal, and on the Malabar coasts, but there are many districts where fish is a rarity. In connexion with this subject, I venture to remark, that the theory of fish-eating being the cause of leprosy, as so ably advocated by no less an authority than Mr. Jonathan Hutchinson, is not supported by facts in India. Leprosy is not more common among the fish-eating people than among other classes. And it occurs in the semi-desert districts of Western Rajpootana, where there are no lakes nor rivers, where water is hundreds of feet from the surface, and where the people rarely see fish.

The subject of salt supply has also received much attention, and salt is generally cheaper and more equally distributed than it was previous

to 1874, when the British Government acquired the control of the great Rajpootana salt lake (from the Native States of Marwar and Jeypoor), thereby being enabled to abolish the costly extensive salt customs hedge. The necessity of salt as an article of diet cannot be questioned, and hence the desirability of rendering salt as cheap as possible. Plenty of salt has also been recommended by Dr. Beaman and others as a prophylactic against cholera. Unfortunately, salt-duty has been too much regarded as a means of revenue. The enhancement of the salt duty in 1888–89, from Rs. 2 to Rs. 2½ *per maund*, materially lessened the consumption for all India.

But the increase of food has depended more on the extension of irrigation than on any other agency. I calculate there are now in India, 18,135 miles of irrigation canals, irrigating 12,956,000 acres; the capital outlay being Rs. 32,495,000. Unfortunately irrigation is not an unmixed blessing, for the problem has yet to be solved how efficient irrigation by raised canals, and waste of water by the native cultivators, may be combined with sufficient drainage. And this notwithstanding that much has been written on the subject, and that an Act was passed in 1886, providing for "the construction, maintenance, and "regulation of canals, and for removing obstruction to drainage." Dr. Cutcliff and others, years since, attributed fevers, enlarged spleens, sterility in women, and impotence in men, to profuse irrigation and insufficient drainage, which raised the water in the wells, rendered dry ground sodden, damped the houses of the people, and caused a serious degeneration of their physique. The census of 1890 has shown a reduction of the number of inhabitants in those districts where drainage channels are interfered with. In one respect the Indian Irrigation Department may be compared with the British Post Office. Both require an expenditure upon them of a larger portion of the considerable revenue they yield to the State.

But the Government of India, in common with most governments, does not like spending money on apparently unproductive works; and engineers do not like the suitability or utility of their constructions questioned. When therefore Dr. Dempster, many years back, pointed out the injurious effects of irrigation on the spleens of the people; when, more recently, Dr. Cutcliff reported as above mentioned; and when, at a still later period, Dr. Farquhar, after laborious investigation, endorsed what had been previously said; the reports of these able officers were, to use a mild term, "pigeon-holed." When, however, her laws are outraged, nature generally revenges herself. Many parts of the country in the neighbourhood of irrigation tanks and canals, especially in the North of India, become covered with *reh*, an incrustation found to consist of about 23 parts of soda, with 17 of sulphuric acid, in combination with smaller proportions of potash, lime, magnesia, silica, and carbonic acid. Where *reh* appears seeds germinate imperfectly, or decay in the ground. Even grass will not grow where *reh* forms. Land which had been highly cultivated became barren and

unproductive. The evil was caused by the canals being higher than the surrounding country. The water percolating through the soil to seek its own level, carried with it the various salts constituting *reh*, and deposited them on the surface of the ground. Here at least was a cogent reason why measures should be taken—but as yet inefficiently—to stop over-irrigation and waste of water, and to combine sufficient drainage with efficient irrigation. If no other remedy is possible except deepening the canals, so that water must be raised to flow over the adjoining country, and so may drain back again, such a method must be pursued, whatever may be the attendant expense. I have here the opinions of Indian sanitary officers on the effects of irrigation :—

Surgeon-major Mac Rury, the Sanitary Commissioner for Bombay, mentions the prevalence of malarious fevers in the vicinity of irrigation canals. Surgeon-major Stephen, the Sanitary Commissioner, Punjaub, states that "since 1868 seven irrigation canals have been opened. In "irrigated tracts of country malarial fevers and their sequelæ are much "more prevalent than they used to be, and the death-rate of these "districts is considerably higher than it was." The Punjaub Government has lately been endeavouring to restrict the amount of water used by putting a higher rate on rice cultivation. The Sanitary Commissioner for Bengal considers that "the effect of irrigation work on the public "health has been the reverse of beneficial." The Madras Sanitary Commissioner considers that irrigation "in the manner in which it is "at present carried out has a prejudicial effect on the public health, "especially in villages situated close to canals." The Sanitary Commissioner of the North-West Provinces and Oude observes that excess of irrigation tends to the formation of swamps, and creates inundations, which cause much sickness and mortality. But the Government of the North-West Provinces are actively engaged in solving the problem of how to effectively combine irrigation with drainage projects.

It is irrigation, however, which has enabled India not only to grow grain enough for herself, but to export large quantities to Europe. But it is new roads, and especially railways, which have been instrumental in distributing the grain. They have enabled food to be conveyed from one province to another comparatively easily and expeditiously.

After the Orissa famine in 1865, an Act was passed providing for more roads, and local boards were appointed on the lines of British road boards. During the famine in Rajpootana (1868–69), General Keatinge, V.C., C.S.I., utilised the labours of the people in cutting a much needed road through the Aravelli Mountains. Personally I do not think the railroad policy has been sufficiently bold; and narrow-gauge lines have been constructed which ought to have been broad. In 1890 there were 56 different lines, the mileage being 16,277. There were also sanctioned, but not opened, 2,272. But much extension is required, which, with our knowledge of the benefits already conferred, ought not to be delayed.

For example, such a famine as I witnessed in Rajpootana in 1868–69, could not now occur. There was then what the Indians term

a "Teen-khal." There was no grass, no grain, no water, so that animals could not be used for the transport of food. This Rajpootana famine extended over 6,500 square miles, principally in Marwar, Bikaneer, and Shakawutty. Colonel, now General Brooke, then Agent to the Governor-General for the States of Rajpootana, who wrote the history of the Rajpootana famine, estimated that from Marwar alone one million of people emigrated, taking with them two millions of cattle. It was also estimated that during the two years of famine—the first year's caused by failure of the rains, the second year's by locusts—one million and a quarter died, purely from starvation or from diseases caused or aggravated by famine, viz., fevers, bowel complaints, and cholera. The anti-opiumists have often stated that famines in India are caused by so much of the land being taken up for opium cultivation, the amount being actually only a fractional part. And as a matter of fact, one great stream of emigrants passed to the West into the opium districts of Malwa, where they found food.

Education, which has made rapid progress in India, must also be mentioned. The number of colleges and schools in British India in 1889-90 was 134,710. The number of scholars was 3,626,398. Of these 294,457 were girls; 20·7 per cent. of all boys and 1·9 per cent. of all girls were attending schools. At the universities there were 13,940 undergraduates, and the degrees gained were numerous; (in arts and science, 1,366; law, 255; medicine, 83; engineering, 30). The total expenditure on education in 1889 was Rs. 2,709,232.

The system of education is based on a despatch from the Secretary of State, dated 1854. Directors of public instruction were appointed for the different provinces, assisted by a staff of inspectors and sub-inspectors. For education, previous to 1854, there were three classes of indigenous schools: the Hindu *boles*, or seats of Sanskrit learning; the Mahomedan *madrassas* and *maktobs*, giving chiefly religious instruction; and *palsalas*, or hedge-schools, where reading, writing, and arithmetic were taught. On the institution of the Educational Department, the schools were classed as departmental, aided, and extra-departmental. In addition, the three Presidency Universities were established, with a chancellor, vice-chancellor, and senate, having power to confer degrees in arts, law, medicine, and engineering. In 1882 a commission of inquiry was formed, with Sir W. W. Hunter as president, and considerable advances were proposed.

Of course, an educated person is more likely to appreciate sanitation than an ignorant person. But it would be well if the broad principles of sanitation and hygiene were taught in all schools, instead of only in some provinces. In the Punjaub, for instance, it is taught in most schools. The "Sanitary Primer" is also used in the schools of Berar, and in some schools elsewhere.

One Sanitary Commissioner, however, observes that "much money "is wasted on education, so called, that should be spent in improving "the water-supply and the cleanliness of towns and villages." Although perhaps we are manufacturing too many B.A.'s in India, we have

fortunately not yet arrived at the point of teaching the piano in the schools.

The following is a list of some of the sanitary works which have been published in India for the benefit of the people, most of which might be used in schools:—1869, "Sanitary Rules for the North-West Provinces," by Dr. Planck; 1870, "Practical Hints for Sanitary Improvements in smaller Municipal Towns," published by Government; 1872, "Observations on the Causes and Prevention of Fevers," by Syed Abdoollah, distributed by order of Government; 1880, Bellew's "Dialogue on Sanitary Matters"; 1880, "The Madras Manual of Hygiene," by Surgeon-major King; 1881, Proclamations issued in some districts, stating "What should be done"; 1882, "The Sanitary Primer," by Surgeon-general Cuningham; 1883, "Water and its Connexion with Public Health," by Deputy Surgeon-general Furnell, showing from the Shastras and Institutes of Menu that present customs are at variance with ancient precepts, printed and circulated at the cost of the Maharajah of Travancore; "Moore's Manual of Family Medicine and Hygiene for India," five editions, the first published in 1874, the last, 1888.

I here quote a recent observation by Surgeon-Major McRury, the Sanitary Commissioner with the Government of Bombay, that "the "study of sanitation by civil officers as part of their curriculum at "home, would be an important reform"; and in the term "civil officers" I would include those of the Educational Department.

In connexion with education I must mention the medical schools. There is one in each of the Presidency cities, having a full staff of professors, the curriculum being accepted for examination by all British examining boards, and there are 15 medical schools elsewhere, affording a good but lower professional scale of education. In the year 1889–90 there were 2,256 male, and 186 female medical students attending these schools. Special lectures on sanitation and hygiene should be instituted at all these schools.

Hospitals and Dispensaries.—In 1859–60 there were not, I believe, more than 181 of such institutions in India, treating 111,116 patients. From the report for 1889–90 I find the number had increased to 1,641 institutions, treating 265,000 indoor, and 11,978,000 out-door patients; total, 12,243,000. Many of these institutions are entirely supported by Government, and the others are more or less so supported.

There are also 25 lunatic asylums, containing 4,976 insanes, entirely supported by Government; and 23 leper hospitals partially supported by Government.

In connexion with this subject it must not be forgotten that under the exertions of the Marchioness of Dufferin, aided by Lady Reay, Lady Lyall, and others, women's hospitals have been established at many places, and lady doctors, midwives, and female nurses have been supplied. The influence of educated medical men, and especially of educated medical women, scattered throughout the country cannot be

over-estimated in relation to sanitary progress. From the last report of the "National Association for supplying medical aid to the women "of India," it appears there are 48 female hospital or dispensaries in operation, nine being in the Native States. There were treated in 1890, 412,591 females, including 51,973 in the hospitals of the Native States. It must not, however, be understood that formerly no women were treated in Indian hospitals, for the number of females in most hospitals was only limited by the number of beds available. But the lady doctors and female hospitals reach a class of Indian women who were by social custom unable to avail themselves of existing means of relief in sickness.

There are also some other matters which have contributed, more or less, to strengthen the public health, and which I can only mention. There is the attention which has been given to forest conservancy which is preventing many parts of the country being reduced to the sterile condition of Western Rajpootana, once a land of forests and food. The influence of forests on climate, and, therefore, on health, does not require demonstration. There are parts of India, as there are parts of China, and of other countries, which have been nearly depopulated by the wholesale destruction of forests (generally for fuel) and the consequent drying up of springs. The destruction of forests following the introduction of tea-planting into Darjeeling, for instance, was most injurious. As early as 1865 a Bill was passed for the protection of forests. A Forest Conservancy Department was established in each province, and there are now in British India upwards of 75,000 square miles of reserved forests, and from 60,000 to 70,000 square miles not reserved. Sir Edwin Arnold observes, "Trees will save India, and are "saving her, from the fate of Central Asia, dessicated by the nakedness "due to want of wood. India would have been a howling wilderness "if the sway of the Mogul and Mahratta had lasted." In connexion with this subject it may be mentioned that there are many records illustrating the advantages of planting trees near villages. Also that the cultivation of the eucalyptus and the sunflower as preventatives of malaria has not been successful.

Next, there is the introduction of the Peruvian bark tree, the cultivation of which has supplied the people with an economical febrifuge. Long before this, however, the Government had authorised the sale of quinine to the people at cost price. The cinchona was first introduced in 1852, but all the plants died. In 1860 plants were again brought from Peru by Mr. Clements Markham, which in 1872 had increased to 2,500,000.

Meteorology has also been specially studied. Admirable annual meteorological reports have been published by Mr. Blandford, for Bengal; Dr. Murray, North-West Provinces; Dr. Neil, Punjaub; Dr. Bonavia, Oude; and Mr. Chambers, Bombay.

Lastly, every endeavour has been made to obtain a correct registration of births and deaths, and an accurate census. But I am sorry

to add, especially as regards deaths, that such endeavours have been ineffectual, and this, under existing conditions, necessarily so. The registration of the causes of death is very imperfect, for there are not medical men throughout the country, as in England, to give certificates of the cause of death. Hence fever in India is credited with greater mortality than it really causes, for the natives regard any ailment accompanied by fever as that disease. As regards the Indian census, I think it may be accepted as fairly accurate, much more so than the registration of the causes of death. That we cannot obtain a quite correct census even in England is sufficiently apparent from the newspaper comments on the taking of the census of this year in England (*vide* "Globe," 7th April 1891). As the agency does not at present exist by which we can obtain a correct registration of deaths throughout the country, it would be advisable to select a few towns and villages in each province, to provide them with the required agency, and to accept the results as indicating the general death-rate.

Turning now to subjects more especially coming under the heading Sanitation, I note the following:—

Conservancy.—The first improvement in conservancy of public institutions was in 1859, when Dr. Hathaway introduced a dry system into the Punjaub jails. Previously, latrines were constructed with chunam (lime cement) floors; ordure was removed by hand, and the privies were washed. Hathaway's method consisted in a flooring of dry earth six inches deep, so that any defilement might be quickly and easily scraped away, and in the absence from the privies of all lime, which by combining with urinary salts liberates ammoniacal gases. The plan was next tried in the Alipoor jail, and in the Calcutta House of Correction; and then by Dr. Wiehe, in the prisons of Bombay. Doubtless this would have been the conservancy system throughout India, for public institutions, had not Moule's dry-earth system been introduced about 1864 (a utilization of earth which, by-the-bye, had long been practised in Italy in connexion with cesspools and large collections of fæcal material). Moule's system was soon generally adopted for hospitals and public institutions. There are, however, several objections to this dry-earth system.

It has been advanced that there are at least three diseases, viz., typhoid or enteric fever, cholera, and worms, disseminated by the medium of fæcal material. Hence has arisen a very grave question as to the advisability of the system of the dry-earth conservancy, and of the wholesale burial of fæcal matter. It has been pointed out that there is every difference between a mere deodorizer and a disinfectant. Unless fæcal matter is smothered in earth it is not even deodorised, and there is some reason to believe that earth does not act with certainty as a disinfectant. Some soils, such as clay and alluvium, retain organic matter for a lengthened period in an undecomposed form. It is on record that, some years ago, a body of prisoners were employed in making a road in the Guntoor district, and that in cutting away the

soil, they came upon the remains of a number of persons who had died of cholera in 1838, and that cholera immediately broke out among the workmen. Again, a party of coolies employed on a railway cutting near Salem, opened a spring of very clear water. Those who drank of it were seized in a few hours with cholera of a very severe type. In this instance the railway cutting passed through an old burial ground. Again, a well known author, Dr. Gibb, imforms us that an epidemic of small-pox at Quebec followed, and by first commencing among the workmen appeared directly attributable to the opening of a small-pox cemetery 214 years old. There are many instances of barracks and bungalows being unhealthy in consequence of the plinth being filled in with rubbish. That the germs of disease may remain for an indefinite period with vitality unimpaired cannot be denied. Were all fæcal matter disinfected by perchloride of mercury or permanganate of potash solutions there would be some additional safeguard. But these measures cannot always be practically enforced, even in public institutions. Under such circumstances, I am not prepared to say that there is no truth in the idea that by the wholesale burial of human ordure now going on we may be storing up epidemic poisons to be turned up hereafter. Quite recently Surgeon Nichols, Surgeon Batterby, A.M.D., and also Dr. Hare, of the Brisbane Hospital, Queensland, have condemned the dry-earth system ("British Medical Journal, 1890"); especially when, as the officer first named remarks, the cart which takes the mixture of earth and fæcal matter to be buried brings back dry earth for use. The term enteric fever first appears in the Indian Army Statistics of Mortality in the year 1870; and although I believe that the fevers which now occur in India are the fevers which have always presented, still others think enteric fever is a comparatively recent but increasing disease there, and would connect it with the wholesale preservation of fæcal matter now going on.

Again, the expense of the dry-earth system, as applied to large numbers, is enormous; for, as before mentioned, unless fæcal matter is smothered in earth the latter is not even a deodorizer. Carrying the immense mass of earth and fæces away is costly; places of burial are not always procurable, and in a short time the mass of refuse from a city would surround it with hidden collections of filth, as military stations are now being surrounded. Another short-coming of the system is that it deals with only one part of the refuse which must be disposed of.

While admitting that the systematic burial of fæcal matter, even from barracks and public institutions, may be storing an evil from which our successors may suffer, and while asserting the impossibility of applying a system so cumbrous to large towns, I am opposed to sewers in India, unless in a locality where an unlimited amount of water can be procured. Often no rain falls for nine months. In most places excessive expenditure would be required for the storage of water alone. All closed sewers, unless constantly flushed, become abominations in

India. The conversion of fæcal matter into manure and its utilization in the cultivation of the land, is the ideal method of Indian conservancy; and until the natives can be generally induced to use such material as manure, I think that the burial of fæcal matter is, notwithstanding all objections, the least undesirable plan. Burning fæcal matters and refuse in furnaces has been tried, but the nuisance, especially during the rains, was too great. Mention should be made that at several places, notably in the neighbourhood of Madras, sewage farms have been instituted, but it appears that the saline nature of the soil prevents their being a great success.

Under the municipal organisation before referred to, most villages of any size have now a more or less efficient conservancy establishment; and for a large number of villages, public latrines have been supplied. But the conservancy of small villages is, perhaps, the most difficult question of Indian sanitation, for in dealing with it we are confronted, *first*, with the scarcity of the class of people who alone will remove fæcal matter; and, *secondly*, by the social habits and customs of the people generally. From time immemorial it has been the custom of the majority of the inhabitants to perform the offices of nature in the neighbouring fields or jungle, but they do not extend their operations to the ancient Mosaic custom of covering deposits. These are frequently eaten by dogs, pigs, sheep, kine, or buffaloes, especially in the hot season when grass is scarce, as the herds pass to and from the grazing grounds. (It is worth while mentioning that some explain the avidity with which the animals seek this filth to their not being supplied with salt in consequence of the dearness of this article.) Certain maladies, tapeworm especially, may be thus propagated, and it is a fact that Indian beef often contains cysts. Two plans have been adopted. *First*, public latrines, as mentioned above. *Secondly*, reservation of enclosed plots of ground. There are serious objections to both plans. The women, especially, dislike resorting to public latrines, and it is impossible to maintain them always perfectly clean and free from smell, even when they are so constructed as to be easily moved to a different site, and even when a sufficient number of attendants are obtainable. As regards reservation of ground, the value of land in the immediate vicinity of most villages is great, but when land is available it is the better plan of the two, although the people complain that they do not obtain the privacy they would in the fields and jungles. Further drawbacks to either plan are that it does not provide for sickness, and that it induces the people to make "kulkuas" or privies on their premises. These are in the shape of holes or wells, and are never cleaned out. When they are full, if a simple hole, pigs may be let in to eat the ordure; or salt is thrown down, which liquefies the mass, and reduces it to a smaller bulk, the liquid portion probably percolating into adjacent wells. After long consideration, I believe it would be better to allow the people to return to their former habits, keeping, however, the cattle tracks free, until means are forthcoming for the application and conduct of a system

of hand labour for those places where a system of sewerage, with plenty of water, cannot be applied. It should be recollected that on the plains of India in the hot weather the putrefactive process is arrested by heat, the bodies of animals even, exposed to the sun, drying up *viâ sicca*, no putrefaction taking place; and the results are not so injurious, as from the *viâ humida* putrefaction occurring in the confinement of sewers and cesspools, when, as often happens, sewer-gas escapes.

I would here mention the paper* on Village Sanitation in India, which has been prepared by Mr. Lionel Ashburner, C.S.I., formerly one of the Honourable Members of Council with the Government of Bombay. It relates especially to the recent Bombay Village Sanitation Act, which is noticed in the Appendix to the present paper giving a detail of sanitary progress in the different provinces of India. In the meantime I may express the belief that this Bombay Village Sanitation Act will probably become a dead letter, for two reasons, 1st, from want of funds; 2nd, from certain regulations which it provides, and which are more or less impracticable. With regard to the financial question, Miss Nightingale has forwarded to me a communication from the Poona Sarvajanik Sabha, who remark,—

"With respect to village sanitation the local government has passed an Act, but as it has not provided for any special funds for the purposes of village sanitation, the Act remains virtually a dead letter. While the Bill was under consideration the native members of the Legislative Council strongly insisted upon the necessity of making a statutory provision of funds for village sanitation by appropriating a portion of the local funds which was originally intended both for improving communications and sanitation. Latterly nearly the whole of the money has been absorbed by the public works and repairs. It was proposed to set apart a definite portion of these local funds proceeds (being eight pice in the rupee of land revenue) for sanitary purposes; but the suggestion of the native members was overruled, and as the people are too poor to pay additional taxes or to raise voluntary subscriptions, and as Government itself is not prepared to make any sensible allotment out of provincial revenue, matters remain at a standstill. If you move the Hygiene Congress to invite the attention of the Indian authorities to this subject, there is every reason to hope that the present inactivity will be remedied."

Drainage.—Although much has been accomplished, drainage is still a great want. Whether or not the *bacillus malariæ* is the cause of so termed malarious fever, it is certain that when people live on a water-logged soil, they suffer from fever. The recent Bengal census demonstrates that there is a marked decrease of population in the Nuddea and Jessore districts, long notorious as fever localities, where natural drainage channels have been blocked. I have here a list of localities where the greatest amount of drainage has been accomplished, but it must be confessed that at most of the places much more remains to be done.

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* Vide p. 145 *postea*.

TABLE II.

SHOWING the LOCALITIES where DRAINAGE has been accomplished to the greatest Extent. Places mentioned in Chronological Order.

PROVINCE.	Town Drainage.	District Drainage.
BENGAL	Calcutta	Hooghly.
	Bogra	Burdwan.
	Hooghly	Honorah.
	Midnapoor	Bogra.
	Darjeeling	Tipperah.
	Rampoor	Palan.
	Barrackpoor	Raipoor.
	Cuttack	Nuddea.
	Dinagepoor	Surpai.
	Lalbagh	Purnea.
	Morshedabad	Midnapoor.
	Patna	Cuttack.
MADRAS	Madras.	
	Ootacamund.	
	Ulsoor.	
BOMBAY	Bombay.	
	Ahmednuggur.	
	Nassick.	
	Sukkur.	
	Broach.	
	Poona.	
NORTH-WEST PROVINCES AND OUDE.	Cawnpoor	Ganges Doab.
	Saharunpoor	Jumna Doab.
	Mozuffurnuggur	Saharunpoor.
	Allahabad	Mozuffunuggur.
	Benares	Kishapoor.
	Sultanpoor	Sumbhal.
	Faizabad	Upper Doab.
	Burra Banki	Lucknow.
	Oona	Rai Bareilly.
	Meerut	Gonda.
	Gurruckpoor	Burra Banki.
	Mynpooree	Bulandsharh.
	Mizapoor	Muttra.
	Agra	Agra.
	Bareilly.	
	Mynu Tal.	
	Benares.	
PUNJAUB	Amritsur	Jullundur.
	Ferozepoor	Neighbourhood of W. Jumna Canal.
	Jagroun	
	Peshawur	Hoshiapoor.
	Ludhiana.	
	Kohat.	
	Hansi.	
	Delhi	
	Jullundur.	
	Simla.	
	Dalhousie.	
	Gujranwolla.	
	Panipat.	
	Bungah.	

Table II.—*continued.*

Province.	Town Drainage.	District Drainage.
Central Provinces -	Nagpoor. Saugor. Chanda. Damoh.	
Berar - - -	Arkola. Murztinapoor. Patoola. Chikalda.	
Assam - - -	Gauhati. Syhlet. Silchar. Goalpura.	
British Rajpootana -	Ajmere.	
Burmah - -	Rangoon. Prome. Bassein. Tungoo. Henzada.	

Drainage is not however the universal panacea which some consider it to be. Subsoil drainage is not applicable to those sandy countries where only a few inches of rain fall, for the sand immediately absorbs the rain like a sponge, and although it remains damp and cold a very short distance from the surface, this would not be much altered by drainage, the moisture not being sufficient to escape from the holding sand by oozing. Surgeon-General Cornish, C.I.E., has also pointed out that subsoil drainage is not applicable to certain districts in the Carnatic, where they do not suffer from too much moisture, but from excessive dryness of the soil. During the prolonged period of drought subsoil pipes become blocked by deposits of ants, lizards, rats, &c., so that when they are really required no water flows through them. This, it may be said is a matter of supervision, and so it is to a considerable degree. But to ascertain the patency of any large extent of subsoil drainage is no easy matter, and deposits of the nature mentioned occur very suddenly. As a matter of fact, when the Indian monsoon bursts, and heavy rain falls, many subsoil drains overflow.

Under this head I venture to quote some recent remarks made by Dr. Simpson, the Health Officer of Calcutta. "It seems to be the "impression that drainage mainly consists in laying down a large "number of pipes, irrespective of a consideration of the nature of the "locality, which may be densely crowded with buildings constructed "on most irregular lines, and by their irregularity rendering effective "drainage almost an impossibility. The pushing on of underground "drainage under these circumstances is a doubtful improvement. It "may improve the appearance of the locality, but it is very questionable "whether it improves the public health. . . . . The greater "my experience of the effects of the network of underground drains "in bustees, the greater is my distrust of their utility and freedom from

" danger. It would be safer and more conducive to the health of the " bustees to restrict underground drains to the broad roads, which " should intersect." All tributary drains should be open, or should be covered with moveable open iron gratings, which would ensure the condition of the drain being readily seen, while the drain being exposed to the influence of the sun and air, injurious gases would not be elaborated.

Vaccination.—The system of vaccination now generally adopted in India is the close inspection, by European and Indian superintendents, of work done by Native subordinates. The establishments of vaccinators are spread over the country, and the European officer follows the vaccinators, verifying by actual inspection the returns they make. Hence, as a general rule, the vaccination is good. Vaccination was first introduced into Bengal in 1802, within four years of its establishment in England. Several attempts made to bring it round the Cape by repeated cow-pox inoculations on board ship failed; but it was at last successfully carried to Bombay through successive stages eastward, viz. Constantinople, Baghdad, Busserah, Bushire.

As vaccination advanced the inoculation of small-pox was prohibited by law; first in Calcutta in 1865, then in several large stations in Bengal in 1866, afterwards in Ghurwall and Kumaon, and in other localities. In Madras, in 53 municipalities, it is compulsory. I recollect that when, years ago, a proposal was made to prohibit inoculation in Bombay, and to substitute compulsory vaccination, a committee of a Native association were deputed to consider the subject. This committee reported that the expected benefits were not sufficient to justify any such law; a conclusion which led to one of the most exhaustive essays on vaccination which has ever been written, by Mr. Lumsdaine, then Sanitary Commissioner with the Government of Bombay.

TABLE III.

SHOWING the ADVANCES of VACCINATION at DECENNIAL PERIODS in the different PROVINCES.

PROVINCES.	Years.		
	1869, 1870, or 1871.	1879, 1880, or 1881.	1889, 1890.
BENGAL - - -	324,266	1,363,925	1,769,525
MADRAS - - -	282,942	587,810	831,499
BOMBAY - - -	397,622	581,051	899,828
NORTH-WEST PROVINCES -	237,298	530,806	710,849
PUNJAUB - - -	292,689	444,710	764,282
CENTRAL PROVINCES - -	102,035	288,367	350,828
BERAR - - -	17,476	74,303	92,695
ASSAM - - -	—	21,170	134,922
COORG - - -	534	3,417	7,165
BRITISH RAJPOOTANA -	5,996	8,695	11,510
BURMAH - - -	—	65,298	112,428

The last Annual Report of Vaccination for the whole of India gives a total of 5,709,462 cases, varying in the different provinces from 56 to 73 per cent. of births.

Some idea of the difficulties experienced in the spread of vaccination in India may be obtained from the following quotation from my article, entitled "Marwar—the Land of Death" (*Indian Annals of Medical Science*, Vol. XX.):—"The population firmly believe variola to be "under the control of the goddess, 'Mata,' or 'Setla Devi,' in whose "honour temples abound and fairs are held . . . . . where "thousands of women and children attend with offerings for the goddess. "The declivities of most of the numerous conical hills present either a "reddened stone or temple, devoted to 'Mata,' with most probably an "attendant Brahmin priest. Nearly every village has its goddess of "small-pox in the immediate locality, and in many places a large piece "of ground is esteemed holy, and called *Mata Ka Than*. The people "do not pray to escape the affection, unless in seasons when it occurs "with more than ordinary violence. They do, however, petition for a "mild visitation. But even the loss of an eye does not appear to be "viewed as a very serious calamity! 'Is there not another eye "'sufficient for all purposes'? questioned a philosopher. 'If it were "'the leg or hand, it would be different, but an eye is immaterial.' "The pitting produced by small-pox is by some considered rather an "addition to beauty than otherwise, as black patches on the face were "among English belles of former days, or as is *pityriasis versicolor* on "the backs of Malabar boatmen of the present day. Moreover, others "imagine that an attack of small-pox not proving fatal, demonstrates "the favour of the goddess on the fortunate individual. As may be "supposed, the establishment of vaccination among such a people is not "an easy matter."

Ventilation of towns and villages.—The ventilation of many towns and villages is impeded by a surrounding wall, or in some parts by a thorn hedge. Such defences were, no doubt, necessary before the *pax Britanica* dominated the land, when wars between different States were chronic, and marauders perambulated the country. But they are not necessary now. It would be well if the example of Bombay were generally followed, and town walls demolished. Often there is also a ditch, which becomes the receptacle of all kinds of rubbish, and this should be filled in.

Water-supply.—Very little attention had been given to the water supply previous to the report of the Royal Sanitary Commission in 1863. Miss Nightingale's sketch of the "Bheestee and Mussack," or "the beginning and the end of the water pipe," represented the ordinary means of distribution, while the sources of supply, in both military cantonments and towns and villages, were extremely unsatisfactory. The Commission reported the condition of the water-supply to be "one of the cardinal defects of Indian stations," and that the water was "often contaminated with organic matter to a dangerous extent." As showing the condition of the water used by the people, I quote the following. Mr. Campbell, the superintendent of police in North Canara, wrote in 1860 of the supply of a village:—"When one "remembers that this tank water washes down from the fields a great "proportion of ordure, the remains of dead animals, and every con- "ceivable filth that accumulates in the environs of a village; and that,

" shallow and unrenewed, it remains stagnant and reeking under a " tropical sun; it does not seem strange that people who have no " other drink should become ill. We visited one of these tanks; " we saw the people going into the water, and before filling their " vessels washing their legs and feet in the very water they were " going to drink. We took some of the water in a tumbler, and found " it of a yellow colour, and so thick we could not see through it."

In my "Review of the Progress of Sanitation in India for the Decennial Period ending 1869" (*Calcutta Review*, 1870), I remarked that the state of matters in Rajpootana was as bad as in Canara. At many places drinking water is only procurable from the village pond, for the wells are all brackish, and the water undrinkable. "Women " not only fill their *gurras* (jars) from the same water they wash in, " but also from the same water the cattle drink from and wallow in, " and often within a few yards of a micturating buffalo." Again, in an article published about the same time, entitled "Marwar—the Land of Death" (*Indian Annals of Medical Science*, No. 20), I observed that in Marwar the only water obtainable is in many localities that of the village pond. This water is used both by human beings and animals for every purpose to which water can be applied. In the hot weather persons used the dry bed for natural purposes, and at other times the banks—a practice not confined to Marwar. Neither do European stations appear to have been much better off. For the Sanitary Commissioner of the Punjaub remarked on "the fæcal matter, " the old bones, the empty sardine boxes, and preserved meat tins," through which Simla water trickled!

One of the first steps taken to remedy this state of matters was a trustworthy analysis of the water-supply of large stations, commenced in 1864–65. In 1866 opinions of various authorities were obtained with regard to the propriety of permitting vegetation to exist in drinking water. In 1869 rules for determining the presence of organic matter in water, framed by Dr. Macnamara, were published by authority. As regards village water-supply, various means of securing better water were adopted. Where the water-supply was wholly or chiefly from the village pond, it was recommended that each village should be supplied with filters composed of double baskets, with a layer of charcoal between (these might be constructed on the same principle of perforated zinc, iron, or wood, or even of stone masonry). Another simple method of obtaining comparatively pure water was recommended by the head of the Medical Department, Bombay. This consisted of digging holes near the margin of tanks, into which comparatively pure water filtered. Where the supply was derived from wells, measures were taken to induce the villagers to protect the wells from impurity, and I may say that many thousands of wells have been so protected and improved. Where the water-supply was obtained from rivers, filtering beds have been constructed at many places; a recent instance being Allahabad, where the present Viceroy lately opened an extensive system of water-works, and congratulated the municipality on the readiness which it had evinced in undertaking the work, and in submitting, on behalf of the citizens of Allahabad, to the pecuniary sacrifices it will involve.

Another recent instance is Ahmedabad, where, on June 11th last, his Excellency Lord Harris, the Governor of Bombay, opened the new waterworks.

In other districts where the physical configuration of the country is favourable, storage-tanks have been formed on distant hills. This is especially the case on the Malabar coast, where the neighbouring range of mountains afforded the desired facilities.

TABLE IV.

SHOWING the PLACES in INDIA where the WATER-SUPPLY has been most improved.

PROVINCES.	Places.	PROVINCES.	Places.
BENGAL - -	Calcutta.	NORTH-WEST PROVINCES AND OUDE.	Almora.
	Hooghly.		Roorkhee.
	Burdwan.		Mussoorie.
	Chittagong.		Agra.
	Dacca.		Dera Doon.
	Pubna.		Allahabad.
	Barrackpoor.		Benares.
	Darjeeling.		Lucknow.
	Derhampoor.		Faizabad.
	Kinseong.		
	Monghyr.	PUNJAUB - -	Kohat.
	Jamulpoor.		Lahore.
	Puri.		R. Pindee.
MADRAS - -	Madras.		Murree.*
	Ootocamund.		Delhi.
	Trimulgherry.		Lahore.
	Coryereram.		Dalhousie.
	Bangalore.		Peshawur.
	Musulipatam.		Dhrumsala.
	Tuticorin.		Abbottabad.
	Nellore.	CENTRAL PROVINCES.	Nagpoor.
	Negapatam.		Jubbulpoor.
	Madura.		Saugor.
	Salem.		Seonee.
	Rumbakonan.		Rajpoor.
BOMBAY - -	Bombay.		Hinghanghat.
	Pundhapoor.		Berhampoor.
	Kurruckwaola.		Raipoor.
	Poona.		Kundwa.
	Alibagh.		Wardhwa.
	Penn.		
	Jham Khandi.	BERAR - -	Shegaom.
	Kholapoor.		Yeotmal.
	Dakoor.		Kamgaom.
	Jalgaom.		Amroati.
	Hyderabad.		Wardali.
	Sholapoor.		Hingowan.
	Rutnagheri.		Janora.
	Satara.		
	Mehda.	BRITISH RAJPOOTANA.	Ajmere.
	Chiplun.		Nusseerabad.
	Vingorla.		
	Kurrachee.	BURMAH - -	Rangoon.
	Roha.		Prome.
	Ahmednuggur.		Bassein.
	Talgoam.		

* A more comprehensive scheme for Murree estimated to cost 6½ lakhs is now in progress.

The investigation of the causes, with a view to the prevention, of disease, has always been a prominent feature in the labours of the Indian Sanitary and Medical Departments. The following is a list of some of the principal subjects which have been scientifically investigated by Indian medical officers. "Delhi Boils," by a Committee, 1864. "Chylous Urine, and the *filaria sanguinis homines*," by Lewis, 1869. "Skin Diseases," by Fox and Farquhar, 1871. "Leprosy," by V. Carter, 1872. "Meat Cysts," by Lewis, 1872. "Fungus Foot Disease," by Carter, 1874. "Delhi Boils," by Lewis and Cunningham, 1876. "Famine Diseases," by Lewis, 1877. "Famine Foods," by King. "Famine, or Spirillum Fever," by V. Carter, 1871. "Guinea Worm," by various Medical Officers. "Snake Poison," at different times, by Fayrer, Wall, Vincent, Richards, Mackenzie, and Ewart. I may, indeed, say that every epidemic of disease has been investigated, and in many localities every single case of cholera. As regards cholera I need only refer to the fact, that so far back as 1860, Drs. Lewis and D. Cunningham were authorised by the Secretary of State to proceed to India to investigate the origin, spread, and prevention of cholera; and to the elaborate and admirable sanitary reports of Surgeon-General Cuninghame, C.I.E., Q.H.S., the Sanitary Commissioner with the Government of India. The principal deductions from experience and investigation, are, *first*, the inadequacy of cordons and quarantine to stay cholera. Cordons were tried, about 1874, round a number of military cantonments, as Roorkhee, Multan, &c., but in no case was cholera prevented. *Secondly*, that the seat of the evil lies in local insanitary conditions. *Thirdly*, as preventive measures there must be strict attention to conservancy and sanitation generally. The truth of the last two deductions as often been proved. I quote one case:— In a report of the Sanitary Commissioners for Madras, the town of Guntur, on the Kristna River is referred to, where cholera was formerly a constant visitor. In præ-municipal days the soil was everywhere polluted by filth, and rubbish was never cleared away. Rest houses for travellers, pilgrims, &c. were always filthy. Prickly pear and croton plants, found in every part of the town and outskirts, were the receptacles of filth. No attention was paid to the water-supply. All classes used the dry tank bed in the dry season, and the banks in the wet season for natural purposes, and the water was also polluted by the washing of clothes, and of the people themselves. In the low-lying portions of the town, where the natural drainage was necessarily defective, all hollows became pools of stagnant water in the rainy season, and in places where water from cattle pens and privies ran into them, exhaled vapours, especially in the early morning, charged with the foulest stench. With such a state of matters the native method of obtaining protection from epidemics was to slaughter annually in sacrifice to the village goddess, and before her idol, several hundred animals, buffalos, pigs, sheep, goats, and fowls. The remedial measures applied by the Guntoor municipality were, the conservancy of streets and lanes by scavengers; inspection of courtyards, and removal of débris; destruction of prickly pear and croton plants; watching the reservoirs to prevent pollution; protection of wells; inspection of the

food supply; cleansing and whitewashing all houses and public buildings periodically; suppression of the silly blood sacrifices. Although cholera has prevailed in the neighbouring districts, it was absent from Guntoor to the date of the report from which the above is taken (1884). *Fourthly*, the removal, when possible, of bodies of men from an infected locality. Removal from an infected locality has been long practised by aboriginal Indian tribes, the Bheels, for instance, and was first proposed for troops by Surgeon-General J. Murray. A commission appointed to inquire into the epidemic of 1861 recommended immediate removal of troops, and so cutting off all communication with the infected locality, and this plan has been generally followed in India since 1864.

But in 1864 the Constantinople Cholera Congress, under the idea that cholera, commencing at Indian shrines, was frequently imported from India to Europe, recommended that in addition to the operations of sanitary commissioners, there should be a regulation of Indian pilgrimages by sanitary cordons. This was rejected under the advice of a Commission immediately nominated by Government to consider the subject. The difficulties were regarded as insurmountable, especially in respect of such gatherings as sometimes take place at Indian shrines, amounting at the Hurdwar great festival to two-and-a-half million people. Quarantine, it was observed, would operate harshly on thousands, and produce evils which would far more than counterbalance any presumed benefits. Mails, travellers, and ordinary traffic, must be stopped, which would interfere with the trade of the country, causing prices to rise. The poor, living from hand to mouth, would suffer from scarcity and high prices, become weakened, and hence predisposed to cholera. It would be calculated to raise alarm, and fright is a great predisposing cause of cholera. It would also lessen the growing confidence of the people in sanitation. Lastly, it would afford guards and police opportunities for oppression and extortion. It was stated by an official in the Punjaub that, "the people preferred the cholera to the quarantine," and indeed this is the feeling all over India. Even in a military cantonment strict quarantine is an impossibility, for supplies must be had from without, and an increased number of guards exposes the men more to the sun and to the night air, rendering them more susceptible to cholera.

But in deference to the Congress, further rules and regulations for the management of fairs and festivals were published. These however only epitomised and authorised the system already in force, which consisted in improvement of the sanitary condition of the town near which the fair is held, and of the lodging houses in the town, especially as regards overcrowding, and in some instances improvement in the shrine itself; warnings issued to the people of the danger they incurred, systematic preparation of the sites to be occupied before the people arrive, the provision of temporary latrines and urinals, and of sweepers and carts for cleansing, and the enforcement of cleanliness; protection of the water sources, supervision of the food for sale, the orderly arrangement of cattle, medical subordinates with the necessary medicines at different points, and the establishment of temporary hospitals;

a watch over pilgrims arriving, not only at the locality itself, but at various distant branch roads and railways, with the view of detecting at once any contagious disorder.

The Congress also required that passports should be issued to pilgrims leaving India for the West, together with increased stringency of the regulations for preventing overcrowding on pilgrim ships, and for the general conduct of such vessels. This resulted in the passing of a revised Pilgrim and Native Passengers Ship Act. By this Act pilgrims were required to take passports. Ships carrying pilgrims were not only to have bills of health, but to submit their vessels to inspection at Aden; also to have improved cooking, washing, and latrine arrangements. Vessels from the Persian Gulf, touching at Indian ports, were also to be submitted to inspection. More recently a Native Passenger Ship Commission was appointed.

Much, however, remains to be accomplished. This will be sufficiently evident when it is stated that more than one third of those who start from Bombay on the Haj never come back.

The accompanying table taken from the "Times of India," of 19th June last, compiled from official records, shows the number of pilgrims leaving and returning to Bombay during six recent years, and although it is possible that some few may return by other routes, they must be few indeed, and can scarcely affect the gross numerical result:—

Years.	Left.	Returned.	Missing.
1885 - -	8,436	5,045	3,391
1886 - -	8,606	6,150	2,456
1887 - -	9,466	5,726	3,740
1888 - -	13,970	6,505	7,465
1889 - -	12,495	10,101	2,394
1890 - -	11,665	8,662	3,003
Total - -	64,638	42,189	22,449

Another statement shows the actual mortality among the pilgrims on the return voyage from Jeddah, the return voyage being, for various reasons, always the most fatal. The returns are for the last eight years, and show the deaths per 1,000 on the basis of a 14 days' voyage.

Years.	Ratio of Deaths per Mille per Annum.
1883 - - -	153
1884 - - -	182
1885 - - -	301
1886 - - -	397
1887 - - -	291
1888 - - -	275
1889 - - -	238
1890 - - -	287

This heavy death-rate on the return voyage is chiefly due to insanitation, privation, and starvation, *before* the pilgrims embark at Jeddah; to overcrowding and sickness on board insanitary ships, and to the fact that a number of the pilgrims are old and more or less infirm. The space at present allowed in pilgrim ships is 9 superficial feet per adult; *i.e.*, 6 feet by 1½ between decks; and 54 cubic feet. In fair weather more than half the passengers permanently occupy the upper deck. But if, as in the monsoon, rain and spray drive them below, the death-rate invariably goes up. Dr. MacCartie, the port officer of Bombay, recommends increase of the accommodation in fair weather to 12 superficial feet and 72 cubic feet, and in the monsoon to 15 superficial feet and 90 cubic feet as the minimum. A certain minimum of sweepers should be insisted upon, and a Government medical officer should accompany each vessel. At present the medical officer is selected by the surgeon-general from among candidates applying for such appointment. For the pilgrim traffic Bombay is the port for the whole of India and for much of Central Asia. The question is one of Imperial interest and demands the attention of the Government of India. But whatever Indian authorities may do there will always be much sickness so long as sanitary conditions are neglected at the ports and places to which the pilgrims resort.

Health officers were also appointed to Indian ports. It has been recently remarked by the Sanitary Commissioner, Bombay, that, unlike what obtains in most other parts of the world, the principal work of the health officer of Bombay is connected with out-going vessels, the export rather than the import of disease being principally guarded against.

The International Congress at Rome in 1885 was more in accord with the Indian view of cholera than previous assemblies, for Sir Guyer Hunter, K.C.M.G., had just shown that cholera existed in Egypt before it was supposed to have been introduced from India. The Rome Congress declared land quarantine to be useless. As regards sea quarantine, five days were to be substituted for seven when cholera had occurred or was suspected, and quarantine was not to be imposed on ships from Indian ports unless cholera had occurred on board. The imposition of quarantine on all ships from Indian ports has always appeared to me absurd. For even allowing that cholera may be communicated, the incubation period is less than the time it takes for a ship to proceed from Bombay to Mecca.

The weight of evidence tends to show that the incubation of cholera is not longer than two or three days. Shortly after the Egyptian authorities instituted quarantine, I brought the subject before the "Bombay Medical and Physical Society." At a full meeting, the members being both Indian and European practitioners, it was voted unanimously that quarantine against Bombay was useless. This conclusion was chiefly arrived at on the grounds that the incubation of cholera was of shorter duration than the passage of a vessel from Bombay to Mecca. It would be impossible to assemble a body of gentlemen having more experience of cholera than those taking part in that meeting. It is worth recalling

that, at this Rome Congress, the freedom of Mecca from cholera in 1884 was attributed by Vice-Consul Abdul Razzack to the sanitary condition of Mona and Mecca having been improved. There would seem, however, to be room for much greater improvement. The pilgrims require more ample space, better arrangements for cleanliness, and pure drinking water free. It is somewhat curious that while certain authorities have not hesitated to urge the Indian Government to stop pilgrimages in India (as the means of preventing cholera, which they think originates at such pilgrimages, and is then conveyed to Europe) such a proposal with regard to pilgrimages to Mecca has never been made. I feel sure that if sanitary measures were carried out at Mecca in the same comprehensive manner in which they are conducted at large Indian pilgrimages, cholera would be the exception at Mecca, as it is now at large Indian shrines.

The question now presents, What is the result of all this? I will first give the opinions of the Sanitary Commissioners, and afterwards my own.

The Sanitary Commissioner for Bengal, Surgeon-major Gregg, thinks that malarial fevers, cholera, and small-pox, have diminished; but the statistics furnished do not appear to support this as regards fever, cholera, and infant mortality.

TABLE V., showing the Death-rate from FEVER and CHOLERA in BENGAL, during the Years 1881 to 1890 inclusive.

Years.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Number of Deaths from fevers.	940,911	229,943	913,766	966,233	1,042,142	1,057,296	1,087,768	1,092,102	1,101,521	1,155,569
Ratio per 1,000 of population.	15·71	14·06	13·81	14·60	15·75	15·97	16·44	16·72	16·53	17·54
Number of Deaths from cholera.	97,180	182,352	90,489	134,421	173,767	118,368	172,578	111,391	1,711,103	145,885
Ratio per 1,000 of population.	1·32	2·75	1·36	2·03	2·62	1·78	2·60	1·68	2·59	2·21

TABLE VI., showing the Death-rate of CHILDREN in BENGAL, during the Years 1881 to 1890 inclusive.

Years.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Number of deaths among children under 5 years of age.	363,045	316,299	316,476	375,530	389,713	432,448	471,021	464,475	484,031	480,088
Ratio per 1,000 of population.	37·42	32·60	32·62	38·71	40·17	43·55	48·56	47·88	49·90	49·99

The Sanitary Commissioner for Bengal remarks, however, that the statistics are based on the census of 1881, and observes that although the returns show an increasing mortality, this is due to better registration.

The Sanitary Commissioner for Madras, Dr. Laing, remarks, in reply to the query if disease has been lessened:—"Yes; but owing "to the Agency, an incompetent one, employed to register births and "deaths, it is difficult to prove that such is the case. More attention "being now paid to registration, the number of deaths registered is "consequently greater. And also, when calculating the death-rates, "no allowance is made for increase of population. Causes of deaths "are very incorrectly stated, and many deaths are entered as due to "fever which are from other causes. Thus, in 1890, the mortality "from fever was high, and this was due to many having died from "disease of the respiratory organs when influenza prevailed, and these "cases were registered as 'fever.'" Dr. Laing gives the following statistics:—

TABLE VII., showing the MORTALITY in the MADRAS PRESIDENCY from the under-mentioned Diseases for the Years noted.

Years.	Number of Deaths.				Ratio per 1,000 of Population.			
	Cholera.	Small-pox.	Fevers.	Diarrhœa and Dysentery.	Cholera.	Small-pox.	Fevers.	Diarrhœa and Dysentery.
Average of the five years ending 1870.	63,821	22,800	122,536	—	2·8	·9	5·2	—
Average of the 10 years ending 1880.	69,330	38,532	269,691	45,265	2·3	1·2	9·1	15
Average of the 10 years ending 1890.	41,368	28,757	219,078	25,851	1·4	·9	7·7	·8

TABLE VIII., showing the DEATH-RATE of CHILDREN under Six Years of Age in the MADRAS PRESIDENCY for the Years from 1871 to 1890, inclusive.

Years.	Number of Deaths.	Ratio per 1,000 of Population.
1871 - - -	132,690	20·2
1872 - - -	170,268	25·9
1873 - - -	165,244	25·1
1874 - - -	171,884	26·1
1875 - - -	201,497	30·1
1876 - - -	191,757	29·1
1877 - - -	369,571	56·2
1878 - - -	174,183	26·5
1879 - - -	128,044	19·4
1880 - - -	147,587	22·4

TABLE VIII.—*continued.*

Years.	Number of Deaths.	Ratio per 1,000 of Population.
1881 - - -	164,858	43·5
1882 - - -	167,265	44·2
1883 - - -	194,494	52·7
1884 - - -	247,669	65·4
1885 - - -	224,679	59·3
1886 - - -	215,207	56·8
1887 - - -	227,198	60·0
1888 - - -	211,236	55·8
1889 - - -	235,273	62·2
1890 - - -	239,921	63·4

But, he adds, that Madras affords an excellent example of the protective value of vaccination when efficiently carried out, and gives the next table in support of this statement.

TABLE IX., showing the DEATH-RATE from SMALL-POX in the CITY of MADRAS from 1871 to 1890, inclusive.

Years.	Deaths from Small-pox.	Ratio per 1,000 of Population.	Years.	Deaths from Small-pox.	Ratio per 1,000 of Population.
1871	234	·62	1881	1,654	4·2
1872	658	1·65	1882	355	·8
1873	1,062	2·6	1883	1,957	4·8
1874	809	2·1	1884*	4,064	10·0
1875	196	·4	1885	26	·06
1876	421	1·0	1886	1	·002
1877	6,758	16·9	1887	13	·03
1878	447	1·1	1888	36	·08
1879	910	2·2	1889	45	·1
1880	869	2·1	1890	69	·2

* Vaccination made compulsory May 1884.

Surgeon-major Mac Rury, the Sanitary Commissioner for the Bombay Presidency, including Sind, writing on the 2nd of May last, does not think that any kind of disease has yet been diminished, excepting small-pox, "because the measures adopted have been few, inadequate, "and incomplete; for instance, want of proper drainage, want of filtration, "and distribution by howds, where a water-supply has been introduced, "as at Poona, Kurrachee, Sholapur, Hyderabad." And he supports his position by the following statistics:—

TABLE X., showing the DEATH-RATE in the BOMBAY PRESIDENCY from different Causes from 1871 to 1890, inclusive.

Years.	Death-rate per 1,000 of Population.						
	Cholera.	Small-pox.	Fevers.	Diarrhœa and Dysentery.	Injuries.	All other Causes.	All Causes.
1871	·41	·66	11·85	2·15	·44	4·25	19·76
1872	1·07	1·83	14·19	2·31	·40	4·63	24·43
1873	·02	·61	11·59	1·62	·37	3·71	19·92
1874	·02	·24	11·33	1·66	·38	3·56	17·17
1875	2·93	·21	13·50	2·07	·38	4·05	23·15
1876	1·90	·70	13·08	1·99	·35	3·78	21·81
1877*	3·53	1·69	20·79	3·72	·46	8·55	38·76
1878*	2·89	·28	22·08	2·54	·47	4·68	32·94
1879	.43	·07	17·66	1·62	·44	3·66	23·88
1880	·04	·06	15·21	1·51	·37	3·06	20·25
1881	1·01	·03	16·56	1·84	·36	3·38	23·18
1882	·48	·10	14·80	1·72	·36	3·41	20·87
1883	2·31	·81	16·21	2·14	·36	3·70	25·53
1884	·84	·88	16·83	2·19	·34	3·74	24·82
1885	2·27	·16	19·10	2·73	·34	4·18	28·78
1886	·01	·05	17·10	2·23	·35	3·43	23·17
1887	1·56	·23	18·76	2·59	·34	4·19	27·67
1888	2·22	·22	13·50	2·76	·35	4·39	28·44
1889	1·97	·48	21·08	2·93	·36	4·74	31·51
1890	·20	·17	20·96	2·19	·36	4·30	28·18

* Famine years.

TABLE XI., showing the DEATH-RATE among CHILDREN in the BOMBAY PRESIDENCY for the Years 1879 to 1890, inclusive.

Years.	Ratio of Deaths per 1,000 of Population.	
	Under 1 Year.	1 Year and under 5.
1879 - -	76·13	20·89
1880 - -	94·55	18·26
1881 - -	164·69	18·26
1882 - -	165·92	33·50
1883 - -	196·02	47·03
1884 - -	214·02	50·68
1885 - -	219·84	58·12
1886 - -	201·54	45·52
1887 - -	217·72	59·80
1888 - -	218·06	57·29
1889 - -	235·39	67·63
1890 - -	215·02	58·28

The sanitary commissioners for the Central Provinces, Deputy-Surgeon General Pilcher, considers that cholera, small-pox, fever and dysentery, have all been lessened by sanitary measures; adding, that, "there can be no doubt that the towns to which a pure water-supply has

" been given, have been freer from cholera." The statistics afforded, however, scarcely support this view of a general diminution of disease :—

TABLE XII., showing the MORTALITY from the under-mentioned DISEASES in the CENTRAL PROVINCES for the 20 Years ending 1890.

Years.	Cholera.		Fever.		Diarrhœa and Dysentery.		Small-Pox.	
	Number of Deaths.	Ratio per 1,000 of Population.	Number of Deaths.	Ratio per 1,000.	Number of Deaths.	Ratio per 1,000.	Number of Deaths.	Ratio per 1,000.
1871	19	·00	48,682	11·06	12,264	1·06	1,435	·02
1872	1,592	·21	128,752	17·71	18,794	2·58	4,172	·57
1873	344	·04	93,813	12·63	12,532	1·68	9,936	1·33
1874	14	·00	118,043	15·94	14,535	1·95	17,696	2·38
1875	14,643	1·98	120,480	16·26	15,562	2·10	20,226	2·73
1876	20,124	2·71	149,786	20·22	19,952	2·70	3,819	·51
1877	3,418	·46	131,123	17·70	14,867	2·01	2,768	·37
1878	40,985	5·53	218,577	29·50	26,098	3·52	16,151	2·18
1879	27,575	3·72	135,933	18·34	19,747	2·66	25,492	3·44
1880	330	·04	136,840	18·36	19,205	2·59	5,184	·69
1881	9,140	1·04	143,933	16·35	22,133	2·51	1,816	·21
1882	11,932	1·36	152,407	17·31	24,639	2·80	3,945	·45
1883	16,235	1·84	175,119	19·86	26,623	3·02	4,696	·53
1884	149	·02	145,342	16·48	21,991	2·49	4,882	·55
1885	21,868	2·48	170,634	19·35	27,455	3·11	3,364	·38
1886	16,679	1·89	176,429	20·01	25,708	2·92	2,774	·31
1887	12,576	1·43	169,326	19·20	26,057	2·95	3,368	·38
1888	921	·10	158,195	17·94	17,618	2·00	10,729	1·22
1889	52,588	5·96	303,052	23·03	25,894	2·94	17,520	1·99
1890	4,787	·54	191,888	21·76	17,721	2·01	2,265	·26

TABLE XIII., showing the NUMBER of DEATHS of CHILDREN in the CENTRAL PROVINCES for the Years from 1875 to 1890 inclusive.

Years.	Under 1 Year.		1 Year and under 5.	
	Male.	Female.	Male.	Female.
1875 - - -	27,114	25,050	21,968	18,966
1876 - - -	32,564	29,571	22,255	19,201
1877 - -	28,689	25,299	16,592	14,196
1878 - -	45,563	42,914	35,863	32,157
1879 - - -	32,504	31,034	25,690	23,198
1880 - - -	36,401	32,953	17,897	16,703
1881 - - -	39,738	36,157	21,287	19,329
1882 - -	42,159	38,081	22,923	21,890
1883 - - -	48,687	45,532	29,819	29,163
1884 - -	41,789	28,005	20,867	19,891
1885 - - -	46,808	43,082	26,241	25,338
1886 - - -	44,736	41,579	26,710	25,770
1887 - - -	43,261	39,477	65,217	24,121
1888 - - -	43,016	38,424	21,591	19,966
1889 - -	55,051	48,445	33,946	30,926
1890 - - -	43,024	37,103	22,088	19,933

The Sanitary Commissioner of the Punjaub, Surgeon-Major Stephen, writing in May last, gives the number of deaths registered under the chief causes as follows:—

TABLE XIV.—DEATH-RATE per 1,000 of POPULATION in the PUNJAUB during the Years 1868–90, inclusive.

Years.	Death-rate per 1,000 of Population, from						
	Cholera.	Small-pox.	Fevers.	Diarrhœa and Dysentery.	Injuries.	All other Causes.	All Causes.
1868	0·03	1·36	8·65	1·02	0·27	3·98	15·
1869	0·53	3·04	15·61	1·77	0·29	4·71	16·
1870	0·03	1·55	15·73	1·56	0·26	4·82	24·
1871	0·02	1·46	12·21	1·24	0·25	5·60	21·
1872	0·50	1·36	15·14	1·33	0·26	6·04	25·
1873	0·01	1·47	12·57	1·12	0·27	4·98	20·
1874	0·04	0·69	10·90	0·94	0·28	5·30	18·
1875	0·36	0·78	16·00	1·57	0·30	6·56	20·
1876	0·33	0·59	20·09	1·56	0·27	5·58	28·
1877	0·01	0·70	12·54	1·01	0·29	5·52	20·
1878	0·01	2·30	25·19	1·83	0·33	6·29	36·
1879	1·49	2·83	27·04	1·69	0·30	5·13	38·
1880	0·01	0·52	18·74	1·18	0·32	6·25	27·
1881	0·28	0·36	18·86	0·92	0·30	6·88	28·
1882	0·02	0·34	18·40	0·85	0·38	6·90	27·
1883	0·01	0·64	16·25	0·77	0·28	7·29	25·
1884	0·03	0·87	24·71	0·97	0·29	8·16	35·
1885	0·10	0·40	18·40	0·94	0·29	6·77	27·
1886	0·06	0·57	17·85	0·95	0·33	6·91	27·
1887	0·47	0·87	23·78	1·30	0·32	7·57	34·
1888	0·79	0·90	20·16	0·90	0·32	6·73	30·
1889	0·15	0·42	22·75	0·96	0·34	7·00	32·
1890	0·18	0·47	36·75	0·91	0·30	8·25	34·

He also furnishes the following figures regarding the death-rate of children:—

TABLE XV.

Years.	Under 1 Year.	1 Year and under 5.	Years.	Death-rate per 1,000 of Population. Under 1 Year.	Death-rate per 1,000 of Population. 1 Year and under 5.
1881 -	145,588	95,483	1881 - -	209·18	52·16
1882 - -	144,312	92,038	1882 - -	208·99	50·30
1883 - -	141,546	91,688	1883 - -	192·60	50·11
1884 - -	199,374	168,780	1884 - -	246·17	92·24
1885 - -	143,787	97,933	1885 - -	196·45	53·52
Aggregate of 1881–85 -	774,558	545,872	Average of 1881–85 -	211·45	59·67
1886 - -	145,812	97,936	1886 - -	195·38	53·53
1887 - -	161,226	151,454	1887 - -	220·06	82·78
1888 - -	140,607	115,702	1888 - -	200·18	63·24
1889 - -	156,750	118,644	1889 - -	206·32	64·84
1890 - -	196,978	208,815	1890 - -	267·46	114·13
Aggregate of 1886–90 -	800,853	692,551	Average of 1886–90 -	217·92	75·70

Note.—The death-rate of children under one year is calculated on the number of births registered year by year.

On this the Sanitary Commissioner remarks,—"The average registered total death-rate for the five years period, 1886–90, is decidedly "greater than the average of the rates registered in former years. "This is doubtless partly due to more efficient registration of deaths, "and to the fact that, in the later years of the period the ratios were "calculated on too small a population. But I am under the impression "that the average death-rate in the Punjaub is really higher than it "was 20 years ago. The statement shows that the principle increase "in late years is registered under the head of fevers"; and, allowing for defective registration, the Sanitary Commissioner is of opinion that "the death-rate from malarial fevers is higher in the Punjaub "than it was 20 years ago"; and he attributes much of this to extensive irrigation. He also remarks, that the statement shows that "cholera "has been epidemic in the Punjaub during the last four years, and "that in former years there was usually an interval of one or two "years between epidemic years, in which only a few sporadic cases "were reported." This greater prevalence of cholera he believes to be due partly to the greater extension of the railway system and to the increased number of travellers.

The Sanitary Commissioner for the North-West Provinces and Oude, says, "Small-pox and cholera have undoubtedly been lessened,

" and the incidence of dysentery and diarrhœa has become less marked " in some places on the introduction of a pure water-supply." Also, " the retardation of small-pox epidemics in becoming apparent; and " in certain districts there is now a marked immunity from the disease " as compared with former times." He supplies the following statistics :—

TABLE XVI.

Years.	Ratio of Deaths per 1,000 of Population.					
	Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other Causes.
1871	·11	1·29	14·25	1·95	·42	1·50
1872	1·63	·97	15·87	2·25	·44	1·58
1873	·49	3·15	14·89	2·26	·49	1·60
1874	·20	3·03	14·61	1·98	·52	1·50
1875	1·33	·84	14·83	2·61	·48	1·71
1876	·85	1·14	16·10	2·88	·43	1·96
1877	·74	·84	13·45	1·98	·46	2·20
1878	·52	3·99	22·99	3·87	·60	3·65
1879	·84	1·79	37·82	1·71	·50	2·22
1880	1·67	·19	23·11	1·88	·48	2·65
1881	·58	·39	24·95	1·88	·48	3·51
1882	2·02	·60	24·90	2·12	·49	3·53
1883	·41	3·14	18·82	1·51	·48	3·21
1884	·68	4·59	24·35	1·73	·48	3·42
1885	1·44	·33	25·48	1·46	·51	2·76
1886	·78	·24	27·58	1·34	·55	2·77
1887	4·54	·19	25·76	1·59	·52	3·23
1888	·42	·56	23·89	1·19	·59	3·43
1889	1·09	1·09	23·10	1·28	·61	3 92
1890	1·82	1·26	28·21	1·22	·60	4·17

The ratio of deaths among children under one year of age in the North-West Provinces and Oude, is given in the following table :—

TABLE XVII.

Years.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1890.
Ratio of deaths to 1,000 births.	288·	269·	222·	274·	211·	229·	223·	213·	234·
Decennial Average.	238·								

On these statistics the Sanitary Commissioner, North-West Provinces, remarks that, " the differentiation of the causes of mortality are " very imperfect. The term fever, as at present adopted in registration " forms and statements, has a very wide and not a limited signification, " and is used by the present registration agency in India as a general

" term to denote the supposed, as they are ordinarily totally unable to " define the real cause of death."

Surgeon-Major Little, the Sanitary Commissioner, Berar, gives the following statement, which indicates a decrease of mortality under cholera, small-pox, and bowel complaints; but an increase under fever, and other causes :—

TABLE XVIII.

Registered Causes of Death.	Ratio per 1,000 of Population.			
	For 10 years ending 1880.	For 10 years ending 1890.	Increase.	Decrease.
Cholera - -	2·8	2·5	—	·3
Small-pox - -	1·4	·3	—	1·1
Fevers - - -	15·7	15·9	·2	—
Bowel complaints -	6·9	5·6	—	1·3
Injuries - . -	·4	·4	—	—
Other Causes - -	5·9	10·4	4·5	—
TOTAL - -	33·4	35·3	1·9	—

On this he observes that "the total mean mortality of the two " periods shows an increase of 1·9 for 1881-90. But against this, " account must be taken of the improvement effected in the registration " of vital statistics, as well as of the increase of population. Cholera " and small-pox are too well known to the people to admit of much " doubt in regard to their diagnosis, so that the figures in the table " may fairly be accepted as correctly showing a lessened mortality from " these two diseases. That the decrease in cholera mortality is due to " improved sanitation would perhaps not be quite a safe assertion; but " that the diminution in the death-rate from small-pox has been due to " sanitary intervention the following figures conclusively prove :—"

TABLE XIX.—RESULTS OF VACCINATION IN BERAR.

Quinquennial Periods.	Mean Ratio per 1,000 of Population successfully Vaccinated.	Mean Death-rate per 1,000 of Population from Small-pox.
1868–72 - -	8·92	2·02
1873–77 - -	25·72	1·56
1878–82 - - -	31·2	·58
1883–87 - -	34·6	·38

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The Sanitary Commissioner for Assam considers that cholera, malarial fever, diarrhœa and dysentery, have been lessened. But, as with the statistics of other provinces, those for Assam do not show much, if any, diminution of disease generally.

TABLE XX., SHOWING the DEATH-RATE from FEVER and CHOLERA in Assam during the 10 Years ending 1890.

Years.	Fevers.		Cholera.	
	Total Deaths.	Death-rate per 1,000 of Population.	Total Deaths.	Death-rate per 1,000 of Population.
1881	42,553	9·49	5,010	1·12
1882	60,128	13·43	21,055	4·69
1883	67,494	14·90	14,908	3·29
1884	66,527	14·69	22,276	4·92
1885	72,482	16·01	7,753	1·71
1886	63,857	14·10	20,188	4·47
1887	65,105	14·38	7,941	1·75
1888	71,825	15·87	9,693	2·14
1889	73,124	16·15	18,228	4·04
1890	74,779	16·52	15,396	3·40

The number of cases of fever, cholera, and dysentery treated at the dispensaries in Assam during the same years are also given by the Sanitary Commissioner, all showing continually increasing numbers. Such figures are, however, only of value as evidencing the growing confidence of the people in the medical institutions.

The Sanitary Commissioner gives the following figures concerning the deaths of children in Assam, but the age is not stated :—

TABLE XXI.

Years.	Number of Deaths of Children.
1881	30,160
1882	44,402
1883	50,464
1884	53,114
1885	50,889
1886	42,136
1887	43,693
1888	51,690
1889	54,120
1890	51,138

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The Sanitary Officer, Coorg, gives the following statistics :—

TABLE XXII.—DEATH RATIO per 1,000 of POPULATION.

Years.	Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other Causes.	Total.
1881 -	·02	·35	15·18	·68	·22	·88	17·90
1882 -	·17	2·61	12·93	·79	·15	·80	17·46
1883 -	—	1·68	18·48	·70	·13	·77	21·75
1884 -	—	·61	12·85	·50	·18	·94	15·08
1885 -	—	1·34	13·21	·70	·21	1·11	16·57
1886 -	—	·27	17·85	·87	·17	1·19	20·33
1887 -	·01	·74	15·39	1·55	·22	1·47	19·41
1888 -	·01	·37	15·31	1·73	·25	1·72	19·41
1889 -	·05	·11	18·35	1·80	·37	2·23	22·92
1890 -	·03	·19	21·52	1·30	·27	2·20	25·32

On these the Sanitary Officer, Coorg, observes that no special influence from sanitation has been remarked, except in the Mercara jail, and in the diminution of small-pox. But he says that the higher death-rate shown for the last two years is probably due to measures taken to secure more accurate registration of deaths. Many deaths are thus registered which in former years would have passed unnoticed. Cholera is a comparatively rare disease in Coorg.

The Sanitary Officer in Rajpootana, Brigade-surgeon Spencer, observes that it is "his strong impression that fevers and dysentery "have been lessened in the capitals." And he adds: "A good example "of the effects of close attention to sanitation is afforded in the remark-"able healthiness, year after year, of the sepoys of the Mhairwarrah "Battalion, also of the prisoners in the Ajmere jail, as compared with "the surrounding population."

Of the city of Ajmere, Surgeon-Major Newman remarks that in 1877 the population was 26,000. In 1891 it was 65,000, Ajmere having become during the interval a great central railway depôt. Yet, notwithstanding this, statistics are furnished which Surgeon-Major Newman rightly considered to show a diminution of disease and a lowering of the death-rate, following the introduction of an improved sanitary system—fevers, bowel complaints, and cholera, all being diminished.

The Sanitary Commissioner, Burmah, Dr. Sinclair, states that malarious fevers, dysentery, and cholera, are certainly less common in several of the larger towns owing to the sanitary improvements effected. With regard to the statistics furnished, Dr. Sinclair remarks that it must be remembered the registration of vital statistics has been, particularly in the earlier years, very inaccurate. Allowance should also be made for increase of population.

TABLE XXIII., showing the MORTALITY from the under-mentioned DISEASES in BRITISH BURMAH for the years from 1872 to 1890 inclusive.

YEARS.	Cholera.		Small-pox.		Fevers.		Diarrhœa and Dysentery.	
	Deaths.	Ratio per 1,000 of Population.	Deaths.	Ratio per 1,000 of Population.	Deaths.	Ratio per 1,000 of Population.	Deaths.	Ratio per 1,000 of Population.
1872	640	·23	845	·30	21,396	7·81	4,804	1·75
1873	8,109	2·23	1,406	·51	19,964	7·28	5,099	1·85
1874	960	·35	1,191	·43	20,137	7·35	4,360	1·59
1875	761	·27	752	·27	25,075	9·15	5,212	1·90
1876	3,678	1·28	1,335	·46	24,728	8·62	5,269	1·83
1877	7,276	2·47	1,230	·41	26,001	8·85	6,879	2·34
1878	6,759	2·29	1,406	·47	28,821	9·76	4,640	1·57
1879	1,828	·59	2,297	·74	26,373	8·52	3,332	1·07
1880	2,638	·85	5,402	1·73	27,597	8·86	3,500	1·12
1881	5,239	1·42	1,766	·48	27,743	7·51	3,808	1·03
1882	7,177	1·96	770	·21	27,093	7·39	3,291	·90
1883	2,185	·60	675	·19	26,283	7·19	2,781	·76
1884	5,515	1·51	6,102	1·67	29,514	8·08	3,719	1·02
1885	7,685	2·10	2,120	·58	34,070	9·32	3,254	·89
1886	4,027	1·10	115	·03	28,444	7·79	2,512	·69
1887	2,647	·73	228	·06	31,825	8·71	2,424	·66
1888	15,982	4·37	571	·16	36,391	9·96	6,459	1·77
1889	3,242	·89	2,812	·77	30,343	8·30	3,080	·85
1890	1,076	·29	3,693	1·01	32,232	8·82	3,067	·84

Now, my opinion of the results of sanitation in India is certainly more favourable than that of some of the officials quoted. For instance, as regards European soldiers, the death-rate has been reduced from 69 per 1,000 to an average for a recent period of years of not more than 14 per mille; and although something may be attributed to increased invaliding, this seems to be counterbalanced by the short service system, under which men are sent out too young, at the age when they are very liable to fever. This is not, as has been supposed, attributable to enteric

fever attacking the young during recent years, for the young were always specially liable to fever in India before the period (1870), when enteric fever first appeared in the reports of the Anglo-Indian army.

TABLE XXIV., showing the DEATH-RATE of EUROPEAN SOLDIERS IN INDIA, from 1881 to 1888 inclusive.

Years.	Death Ratio of European Soldiers per 1,000.
1881 - - -	16·86
1882 - - -	12·07
1883 - - -	10·88
1884 - - -	12·56
1885 - - -	14·55
1886 - - -	15·18
1887 - - -	14·20
1888 - - -	14·84

In a recent review by the Army Sanitary Commission, on sanitary progress in India, it is remarked, that "in former days Northern Indian "stations used to be deadly localities for the British soldier." These are the stations where the largest expense has been incurred in sanitary matters. Yet, with the results shown, it is impossible to deny that the expenditure has yielded the most satisfactory result.

As regards Europeans generally, some insurance offices will insure the lives of those going to India without exacting an extra premium; other offices remit the premium after five years.

As early as 1875, Surgeon-General Cornish, C.I.E., Madras, remarked on the increased value of European life confirmed by the accumulation of elderly officials in India. He considered allowance had not been made for the changed and improved conditions of existence in India. In 1887, Dr. Coates, Sanitary Commissioner, Bengal, remarked on the immunity of Europeans from cholera and bowel complaints. Both European men and women were freer from disease and longer lived than the natives themselves, owing to the alteration which had taken place in their habits and customs.

As regards the population generally, it was mentioned that the death-rate of former years had been conjectured at 35 per 1,000, but that it was most probably much more. Even now, owing to defective registration and census, there are not sufficient data to form any very accurate opinion as to what the normal death-rate really is. But according to the official reports of recent years, as given below, the average seems to be about 26·67 per 1,000:—

TABLE XXV.

Years.	Ratio per 1,000 of Population.
1885 - - -	26·44
1886 - - -	26·12
1887 - - -	25·34
1888 - - -	28·35
1889 - - -	25·74
1890 - - -	28·05

There is no doubt that certain diseases have diminished, and that some have been all but exterminated. For example, when I went to India in 1852, guinea-worm was endemic in Bombay. Since the abundant supply of water, an instance of guinea-worm is quite exceptional.

The only locality where guinea-worm has recently occurred in the neighbourhood of Bombay, is the town of Gowarree, which till 1881, drew its water-supply from wells, while the surrounding villages, supplied with water from the Vehar lake, had no guinea-worm. Delhi sore is another malady which has been almost banished, as many think, by better water-supply. Dysentery has become much less prevalent and violent among Europeans; and, as I think, also among natives; an opinion supported by several of the sanitary officials. I have already referred to the banishment of cholera from an Indian town by sanitary measures. We have also to a great extent abolished cholera at the large pilgrim gatherings of India. Formerly it might truthfully be said "cholera will be there," now we can say, "cholera will probably not occur."

The following are a few instances from many which might be noted of fairs and festivals being free from cholera. For 1884, in the Madras Presidency, the statistical facts regarding cholera may be summed up as follows:—The total number of deaths from cholera in the Presidency were 75,476; fairs and festivals were held in 17 districts; the deaths in these districts were 70,368. In the course of the year 133 fairs were held, at which some 2,000,000 of people were present, the total mortality being 27 deaths, or in the approximate ratio of 0·013 per 1,000 of the total attendance. In 1885, 73 fairs were held in Madras, the number of people present being estimated at 1,094,676. Properly speaking there was no cholera at any of these fairs, but there was cholera at seven of the towns near which the fairs were held. Of the very large number of fairs held in Bengal in 1886, all escaped cholera excepting four.

In Madras, in 1887, there were 91 fairs and festivals, cholera only occurring at one. Additional instances, which had previously occurred, are the great Congeveram festival, at which 286,676 people were present, where there was no cholera, although it prevailed in the neighbouring districts. At the Dola festival, where 60,000 people assembled, there was no cholera, while the district itself lost 3,322 people. Forty thousand pilgrims at Kottapakonda, in Kistna, escaped cholera, while the district lost 4,800 people. To these examples should

be added the immunity of the pilgrims from cholera at the late great fair at Hurdwar, or Kumbh Mela, of 1891.

Again, in former days when a regiment marched, and especially when a Madras regiment marched, or when a regiment moved on the Ganges in boats, cholera was a constant attendant. Now it is exceptional. The Sanitary Commissioner for the Punjaub remarks that outbreaks of cholera in municipal towns are now rare, because they are better sanitated than villages, in which cholera frequently occurs.

A following table gives the number of deaths from cholera and some other diseases in the city of Bombay during a series of years, and shows a remarkable decrease, of cholera especially.

Leprosy.—As we are now awaiting the report of the Commission investigating leprosy in India, I shall merely remark that I do not think leprosy is more prevalent in India than in former years. There are, however, no reliable statistics on this head. Railways have enabled lepers to flock to the large centres where they find better opportunities of living on alms. The only reason which may have increased the number of lepers is the suppression by the British Government of "sumajh," or the burial alive of lepers, formerly a common practice. This was always done with the consent of the leper, who—frequently declaring to his relatives and friends that he was tired of life—would ask them to perform "sumajh." Then a hole was dug, and the leper escorted to the grave with flags, drums, "tom-toms," and other native un-musical instruments. The leper was placed in the hole in a sitting posture, and the earth filled in.

It should be recollected that when leprosy prevailed in England—or rather when—as the Rev. Dr. Jessop states (*Village Life in England, three hundred Years ago*)—"at the outskirts of every town "there were crawling about emaciated creatures covered with loathsome "sores, called by the common name lepers"—at this time the most rudimentary sanitation did not exist. I regard the segregation of lepers in India as practically impossible. And I feel more confidence in the diminution of leprosy in India under the influence of advancing civilization and the consequent progress of sanitation in the most extended sense of the term, in which I include the cleansing generally of towns and villages, drainage, ventilation, good water supply, the cheapening of salt, the prevention of local scarcity, the promulgation of a knowledge of personal and domestic hygiene, opposition to imprudent marriages, and measures for the prevention of specific disease.

Unfortunately, fever still remains *the* disease of India. For 1889–90 no less than 18·01 per cent. of deaths were attributed to this ailment. Although numerous deaths are recorded as from fever which are not so, still the statistics of hospitals and dispensaries show that fever is the prevalent disease. And I here observe that opium is used extensively as a prophylactic in many parts of India. If the use of opium were, as its opponents desire, limited to physcians' prescriptions, I have no doubt that Indian fevers would alarmingly increase. It has been asserted, however, that various localities formerly very

"feverish" have become less so. Or, as I would rather state it, sanitation, and improved habits of life and of personal hygiene, have prevented fevers.

Years ago a writer said of Bombay, "I reckon they walk in "charnel houses; in 500, 100 survive not." Now, Bombay, with its copious water-supply, with its extensive system of drainage and sewerage, and with its able health officer, is perhaps the most salubrious of tropical cities.

From a communication received from Dr. Weir, the Health Officer of Bombay, I find that since 1878 Rs. 58,89,731 (588,973*l.*) have been sanctioned for drainage; and that nearly 56 miles of new sewers have been constructed, and nearly six miles of new covered drains. On water-supply the expenditure has been over Rs. 2,00,00,000 (2,000,000*l.*) Dr. Weir gives figures showing the low death-rate of Europeans in Bombay, and the decrease of cholera since an ample water supply has been introduced.

Surgeon-General Lumsdaine, formerly Sanitary Commissioner, Bombay, has kindly forwarded the following note on the improved sanitary condition of the city:—

"Assuming that Bombay is one of the most important places in the Indian Empire, it is satisfactory to note that its sanitary condition is to-day immeasurably in advance of what it was not many years ago. There was a time within the memory of many when the water-supply was of doubtful quality and lamentably inadequate. Now its purity is a first safeguard, its distribution brings it within the reach of all, and a scheme now approaching completion will raise it in excess of what is considered ample for all purposes. Of drainage and sewerage there was formerly nothing worthy of the name. The drains were a standing menace, and their outfalls were a reproach,—combining, as they did, a maximum of offensiveness with a minimum of efficiency. The greater portion of the house-waste befouled the subsoil; indifferently made wells and cesspools were too frequently in dangerous proximity; and the crowning difficulty was that the people were wedded to habits as primitive as they were repulsive. As with the water-supply, so with the drainage. There is now under construction a scheme which in all its details has been carefully thought out, and is being carefully supervised. Special appliances have been designed to suit Eastern customs, and the extension of their adoption is now a question of time. Provision has also been made to meet the needs of the poorer classes; and, when all is finished, it is not too much to say that from a sanitary standpoint the city will be as well cared for as any either here or elsewhere. The want of scavengering was once a public scandal; but now all is done under the competent staff of a department organised and trained in their duties by the late Dr. Hewlett. The vaccination is carried on both in private houses and in duly appointed centres. Burials and cremation are well watched. In all that relates to the public duties of a public body the Bombay Corporation will compare favourably with similar bodies elsewhere."

The following table shows especially the remarkable decline of cholera in the city of Bombay :—

TABLE XXVI.

Years.	Deaths from			
	Cholera.	Fevers.	Small-Pox.	Diarrhœa and Dysentery.
1850	2,997	—	—	—
1851	5,485	—	—	—
1852	1,520	—	—	—
1853	1,148	—	—	—
1854	3,507	—	—	—
1855	1,645	—	—	—
1856	1,866	—	—	—
1857	2,381	—	—	—
1858	1,115	—	—	—
1859	1,985	—	—	—
1860	1,961	—	—	—
1861	641	—	—	—
1862	3,170	—	—	—
1863	2,209	—	—	—
1864*	4,847	12,593	—	—
1865	2,887	18,767	—	—
1866	332	9,870	—	—
1867	111	5,674	—	—
1868	227	5,481	—	—
1869	754	5,108	—	—
1870	386	4,745	—	—
1871	263	6,341	—	—
1872	190	7,512	1,854	—
1873	95	6,156	764	—
1874	20	5,403	261	—
1875	847	5,244	248	—
1876	378	5,867	3,174	—
1877†	2,550	12,832	958	—
1878†	1,183	9,444	357	—
1879	374	8,445	479	2,494
1880	30	7,513	207	2,062
1881	546	6,437	35	2,602
1882	192	5,453	92	1,618
1883	1,027	5,903	1,461	1,806
1884	576	6,830	112	1,716
1885	598	6,648	55	1,545
1886	19	5,820	19	1,516
1887	269	5,612	108	1,640
1888	379	6,642	482	1,716

* Establishment of the public health department in Bombay. † Famine years.

Of Madras, it is on record that in the year 1757, only 5 out of 250 soldiers who came to Madras in August of the previous year survived. By the latest available report, the death-rate of European soldiers in Madras is 15·55 per 1,000. Dr. Niel Cook, the Health Officer of Madras, has kindly supplied me with a note on the sanitation of that city. Madras has had a water-supply since 1872, when the water of the Cortelliar river was directed into the artificial tanks of Cholaveram and Red Hills,

the water-works as they now stand having cost some Rs. 17,000,000. In 1878 a scheme of drainage was introduced. But there is yet much to be done. No night-soil is supposed to enter into the drains, and for nearly the whole city there is house to house collection, the night-soil being eventually converted into poudrette. The sewage finds its way to distant sewage farms, which are said to be now practically self supporting. Street sweepings are collected and used for filling in marshy land. Cineration was tried, but was not successful, owing to damp in the monsoon and moist rubbish at other times. During the years 1880–1890 inclusive, Rs. 5,463,322 have been spent on sanitary objects, being 32·30 per cent. of the municipal income. Dr. Cooke shows by statistics that both small-pox and cholera have been much reduced. A table showing the diminution of small-pox in Madras has been already given from the sanitary commissioner's report. Regarding cholera, Dr. Cook supplies the following table :—

TABLE XXVII., showing the NUMBER of DEATHS from CHOLERA in MADRAS, from 1885 to 1890 inclusive.

Years.	Deaths.	Years.	Deaths.
1855	1,956	1873	6
1856*	805	1874	0
1857*	1,378	1875	935
1858*	1,965	1876	2,105
1859	1,082	1877	6,246
1860	2,580	1878	85
1861	2,776	1879	35
1862	3,635	1880	2
1863	1,684	1881	126
1864	574	1882	461
1865	944	1883	169
1866	2,984	1884	1,193
1867	614	1885	184
1868	13	1886	4
1869	568	1887	530
1870	861	1888	543
1871	493	1889	182
1872†	5	1890	744

* Famine years. † Red Hill water supplied.

In an address on Sanitation in Southern India, delivered at the annual meeting of the Madras Branch of the British Medical Association (1890), Deputy Surgeon-General Roe compared the sickness and mortality among British troops during two decennial periods, 1826–35 and 1878–87. The admissions per 1,000 were decreased from 1,850 to 1,121, and the average daily sick from 92 to 65 per 1,000. Even allowing for increased invaliding, there is a gain of 24 per 1,000 in the death-rate. Dr. Roe says, "Madras must once have been famous, or "rather infamous, for dysentery. During the first decennial period, "18 men out of every 1,000 were doomed to die annually of this "disease." Now, the deaths have been reduced to 1 per 1,000. This wonderful change is due partly to improved methods of treatment,

but chiefly, Dr. Roe thinks, to improved sanitary arrangements, including food-supply, extra space, precautions against chills, &c. As regards cholera, Dr. Roe says, "The great reduction in this disease— "from 35 to 1·5 per 1,000—is due solely to improved sanitation, for "the disease is still prevalent among the native population."

Of Calcutta, Brigade Surgeon McLeod has recently observed, "Time "was when people began the cold weather with congratulating each "other on having escaped the perils of the hot weather and rains. "Now malarious fevers have been all but banished from the city, and "the type of many diseases, especially dysentery, has got milder, and "life is more secure than it was." He also states, "History tells us "of great plagues in former times. For the five years from 1832 to "1836, the mortality was 51 per 1,000. The present rate is 30°." Dr. Macnamara, in his work on Cholera, gives the average of cholera deaths in Calcutta for 26 years ending 1860, the annual mean being 4,011 deaths. The annual mean of the years 1865 to 1869 was 4,388; and for 1870 to 1882, the period of improved drainage and water supply, 1,385. This represents a saving of 3,000 lives yearly, or of 40,000 in 13 years. The total mortality from small-pox in the decade 1873–82 was 3,600, against 6,058 in the preceding decade.

Dr. W. J. Simpson, Health Officer, Calcutta, gives the following as the number of deaths from the four principal diseases named from 1865 to 1888 inclusive.

TABLE XXVIII.

—	Fevers.	Cholera.	Diarrhœa and Dysentery.	Small-pox.
1865	5,402	5,078	3,315	4,923
1866	5,497	6,826	3,809	83
1867	3,845	2,270	2,398	30
1868	3,681	4,186	2,414	43
1869	3,833	3,582	2,000	39
1870	3,577	1,558	1,699	150
1871	4,242	796	1,488	33
1872	4,895	1,102	1,365	18
1873	4,632	1,105	1,351	33
1874	4,461	1,245	1,358	120
1875	5,328	1,674	1,579	720
1876	4,361	1,851	1,864	71
1877	5,151	1,418	1,683	67
1878	6,086	1,338	2,010	1,493
1879	4,796	1,186	1,516	772
1880	3,797	805	1,267	114
1881	3,765	1,693	1,491	133
1882	3,618	2,240	1,454	17
1883	3,442	2,037	1,307	73
1884	3,618	2,072	1,209	478
1885	3,831	1,603	1,655	155
1886	3,422	1,741	1,258	15
1887	3,253	1,198	1,197	2
1888	3,198	1,734	1,056	12
1889	—	—	—	—
1890	—	—	—	—

With reference to the above, it may be mentioned that during 10 recent years the mortality was 27¾ per mille where there was a water supply to the City, and 47 per mille where there was no supply.

It appears to me that while we cannot, by the statistics available, show any great reduction of mortality for the whole of India, or even for any of the different provinces of India taken separately, there is no doubt that we can by statistics of various large towns and cities taken separately, show large reductions in mortality, and in the prevalence of disease; such towns and cities being the localities where sanitation has made the greatest advances.

There is also another result to which I look with great satisfaction. This is the greater interest which the better educated classes are now taking in, at least, external sanitation. Some time ago the Municipal Commissioner for Bombay, said "Nothing has struck me more of late "than the evident recognition by the more intelligent that mortality "from certain diseases is due to want of ordinary sanitary precautions. "A few years ago double the present mortality would have hardly "excited attention. Now one death spreads alarm, and the Health "Department is promptly invoked."

In the Madras Municipal Report for 1878 it is stated that appeals for drainage reach this department from distant quarters of the town.

I have here the opinion of the various sanitary commissioners on the attitude of the people towards sanitation :—

Under this head the Sanitary Commissioner for Bombay remarks that the people are "gradually but slowly" appreciating sanitation. The Sanitary Commissioner for the Punjaub says, "The leading classes "of the larger municipal towns are becoming more disposed to adopt "sanitary measures. The educated classes are learning to appreciate "the advantages of certain sanitary improvements." The Sanitary Commissioner for the Central Provinces observes, "There is here "and there evidence of awakening to sanitary necessities. All "appreciate pure water and the necessity for providing it. All persons "of every grade feel the relief of an efficient conservancy, and readily "submit to be driven to adopt a line of seemingly public spirited "action." The Sanitary Commissioner for Assam says, "Only the "educated community who live under the supervision of municipalities "are becoming more disposed to adopt sanitation." The Sanitary Commissioner for Bengal thinks the people are becoming more disposed to adopt sanitary measures, "not so much in rural areas as in towns." The Sanitary Commissioner for Madras states "The people are becoming "more disposed to adopt sanitary measures." The Sanitary Commissioner for Berar says much the same. The Sanitary Commissioner, North-West Provinces says, "Undoubtedly the educated classes see the "benefit of sanitary measures."

Lastly, I mention that the census of British India, taken at the beginning of the present year, shows the population to be 285,000,000, an increase of 30,000,000 since 1881. No doubt greater accuracy has contributed to this result, but at the same time, I feel sure that, had there been no sanitation such a result would not have been shown.

Although, as I think, the results are good, I am aware that some persons—chiefly those unacquainted with the country—consider the results should be better, especially as regards the fiction of conveyance of disease from India to Europe. To such I say, learn the difficulties with which we have had to contend. First, there is the tropical climate with a mean temperature 20° degrees higher than most of Europe, rendering European supervision more laborious and expensive, while nothing can be done without it. Then there is the varying rainfall, from 600 inches annually at Cheraponjee to 3 or 4 inches in Scinde. Then there are occasional cyclones, one of which breached the Madras Red Hills reservoir in 1874. Then the sewers best adapted for conveying fæcal matters could never meet the extraordinary falls of rain often occurring in the East. Then there are the differing geological conditions. In Lower Bengal the whole of the surface is sedimentary deposit, 10 feet deep, overlying clay almost impervious to water. In Southern India there is black soil; in Western India sand. In the first districts named water is a few feet from the surface, in the last district it may be 800 feet. Often, when one district is inundated by heavy rains or by silting up and overflowing rivers, another is suffering from drought. Then there is the extent of the country, some 1,372,588 square miles; and the number of the population, some 285,000,000 (only 5 per cent. of whom live under municipal control,) inhabiting 714,707 towns and villages, some of which are so radically badly planned or sited that nothing short of pulling down and rebuilding the whole would afford perfect sanitation; many others being mere collections of grass huts, the inhabitants of which could not assist pecuniarily in any measure of sanitation, and would not practice it unless coerced by the constant presence of an official. Then the density of the population varies from 15 per square mile in Thur and Parkur, to 35,145 in Bombay. A population, the majority of whom exist in poverty, divided into various distinct nationalities, speaking more or less different languages, professing various religions, and having diverse social habits and customs and different modes of disposal of the dead. Surgeon-General Cornish, of Madras, said, "Pariahs and Sudras of the "lowest caste have habits as barbarous and uncivilised as those of their "rude ancestors of the stone age." Then there is ignorance, for in former times learning of any kind was held among Hindus to be the prerogative of the Brahmins, and by Mahomedans to centre in the Koran, and it has been shown that at present only 21 per cent. of the rising generation attend schools. There is also the strong impression that fate or "nusseeb" rules all things. Then there is the constant apathy, doubtless intensified by centuries of generations living and dying under a tropical sun. The cry of the Indian ryot has always been to be let alone. He is born in his caste; eats, drinks, marries, and dies in his caste. He wants neither *ticcus* (vaccination) nor "sanitation botheration," nor least of all *taccus* (tax) to pay for it. Custom, or as he calls it *dustoor*, is to him more important than aught else. An instance of this is afforded by Cumbun, in Madras. Here there are more tombs than living people. One corpse at least lies

under every spot not occupied by house or street. The inhabitants preferred the abandonment of Cumbun, or death by what they call fate and we call poison, to interference with the custom of burying the dead of the present generation in the remains of the past.

Perhaps the greatest difficulties we have to contend with are found in the internal social life of the people. For while there may be, and is, a certain amount of authoritative interference outside, it cannot be extended inside houses, or to the personal hygiene of the people.

Dr. Planck, the Sanitary Commissioner of the N.W. Provinces thus described the house of a Bunya "of highly respectable appearance. "Beyond the threshold is an anti-chamber which is a latrine, the results "not hidden in any way. The owner says it is the children, and convenient "for the sweeper. Beyond the anti-chamber is a small room, which leads "to an inner court. This room is the stable for a pony, which leaves "little space for passers-by, and it is impossible to avoid the litter and "moisture on the floor. The court has clean alcoves used as sleeping "places. Its open floor is moist where much water has been spilt by "the washing of vessels, especially about the mouth of a drain which "leads to the public way. A heap of broken timber lies to one side, "and a heap of broken bricks fills a corner. It is a fact that decency, "cleanliness, and order, which we call comfort, have no existence in "an ordinary Indian home. A man's period of respectability is his "time abroad."

Notwithstanding all sanitary measures which can be applied, certain classes of disease must always be rife among people living as the masses of the natives of India do. They work hard under a tropical sun, and live scant; they sleep habitually outside on the ground, which, even in hot India, is often damp, or in the rainy season in unventilated houses; they may have privies and wells on the premises, which are rarely cleaned out; they keep cattle in or near their houses; they are utterly careless about their water; they wash on the earthen flooring of their houses, and allow the water to soak in, or they wash their clothing and their bodies at a well or stream, often in a cold morning wind, and putting their clothing on wet, allow it to dry on their persons. They habitually wear cotton clothing without any reference to those diurnal and seasonal changes of temperature which are so marked in India.

A fall of a few degrees of temperature in the tropics will make a much greater impression than a fall of many more degrees in a temperate zone, the inhabitants of which have not cutaneous surfaces debilitated by the excessive action caused by heat, and are better protected by their habits, clothing, and houses. And although the dark skin of the native is not so sensitive as that of the European, still they are very susceptible to the effects of cold.

Another great difficulty is the pecuniary one, and this especially in connexion with the smaller towns and villages, the poverty of whose inhabitants has been already referred to. Of Egypt, it has been recently observed in the "British Medical Journal," July 11th, "for "the year 1891, the budgets of the three great departments whose duty "it is to protect Egypt against its three chief enemies, viz., invasion,

" inundation, and decimation, have been fixed as follows:—War, " 447,000*l.*; public works, 458,000*l.*; sanitation, 70,000*l.* In order " to place the sanitary department on an equal footing with the Army " and Irrigation Departments, its budget should be brought up to the " level of those great administrations. Sanitary works properly so- " called could then be undertaken, and the country placed in the course " of a few years in a position to resist, with some chance of success, the " attacks of cholera and other epidemics." Perhaps this is too much to expect, at least for India! And, as a general rule, the principle is a correct one which requires the people themselves to pay for their sanitation. But there are exceptions to every rule. Miss Nightingale has pithily observed to me, " It seems a curious thing that the poverty- " stricken villagers are made to pay for their own hygiene, the want of " which makes their poverty, their ill-health, and their mortality." I would solicit the attention of the Indian authorities to the representations of the Poona Savajanik Sabha, previously referred to, viz., to set apart a definite proportion of the local funds for village sanitary purposes.

Another difficulty which, with increased funds, might be removed, is the want of power of the sanitary authorities to remedy insanitation. When local bodies will not act, the sanitary department should have power to make them do so. But this extended power could not be conferred without much care. It has been said that anyone of average intellect would do for a sanitary officer, which is a mistake. The arts of sanitation and hygiene are not based on any special science of their own, but are the application to practical ends of principles derived from other sciences, and a sanitarian requires as much training as a soldier or an engineer. He requires a considerable proportion of that special knowledge which appertains to the physiologist, geologist, meteorologist, topographists, chemist, engineer, and mechanic. It has been already mentioned how, at the initiation of sanitation in India, it was found necessary to replace civilians by medical officers as sanitary commissioners.

But even a medical officer requires a considerable amount of special training to become a sanitarian, although by previous education he is best fitted to acquire such extra knowledge. There should also be a sanitary and medical member of both the Indian Council and the Council of the Viceroy, and these officials should control the whole sanitation of India. Such appointments would tend much to evidence to the people of India the importance attached to sanitary improvement, and such officials would be able to decide authoritatively when a proposed measure should be carried out, or when it is impracticable (as some have been).

I have said nothing about the sanitation of Native States, which, so far as Rajpootana is concerned, will be treated of by Surgeon-Major Hendley, C.I.E. The fact is, however, that sanitation, commencing with feeble steps, is now advancing rapidly and with firm strides in nearly all the capitals of the Native States, and many costly improvements have been carried out.

Military Sanitation.—It was mentioned that when the Government of India sanctioned the appointment of sanitary commissioners, it was announced that such officers were created for the benefit of the people. As previously noted (in the statement giving the strength of the Sanitary Department), the sanitary commissioners, excepting the sanitary commissioners with the Government of India, and the sanitary commissioners with the governments of Bombay and Madras, have nothing to do with military sanitation. This is controlled by the surgeon-generals of the armies of Bengal, Madras, and Bombay, and by the deputy surgeons-generals of divisions, the executive sanitary officer being the cantonment magistrate, who is assisted by cantonment committees. The first decided step in military sanitation was the issue by Lord Herbert, in 1859, of certain sanitary regulations; and about the same period the senior medical officer at all military stations was nominated *ex officio* sanitary officer. A standard plan for barracks (by Colonel Crommelin, R.E.) was laid down in the Public Works Code, 1859, giving the minimum of space per man as 1,000 cubic feet, with an area of 64 square feet. A standard plan for the accommodation of married soldiers' wives and children was also adopted. Standard plans were also prepared for military hospitals. In the same year uniform conservancy arrangements were prescribed, privies and cesspools being abolished and hand conservancy substituted. At a later period (1864) the dry earth system was adopted. In the same year "Suggestions in regard to Sanitary Work required for improving Indian Stations," were published, and rules and regulations, prepared by a special committee, were adopted and passed under sec. 19 of Act 22 of 1864. At this time it was reported that in almost every station of the Bengal Presidency new barracks were in course of construction, or old barracks were undergoing improvements; Barrackpoor, Dum Dum, Cawnpoor, Agra, Allahabad, Gwalior, Peshawur, Delhi, Multan, Jullundur, Umballa, Mussooree, and Dalhousie being specially referred to. Nor did the other Presidencies lag behind.

It would be tedious to detail chronologically the different steps which have been taken with regard to the water-supply of military cantonments; the soldier's diet and clothing; his recreation and amusement; the prevention of intemperance; the use of hill sanatoria; the rationing of soldiers on board ship, and the general management of transport arrangements; the arrangements of camps and marching; the provision of female nurses; and the many other matters of sanitation and hygiene which have received attention. I must, however, briefly refer to several matters which still urgently demand attention.

First there is venereal disease, which is so common in India. Although the results of the working of the rules for the prevention of venereal disease have not been so satisfactory as could be desired, the experience of certain stations where the rules have been carefully administered shows, beyond all question, that with proper management a very decided impression may be made on the prevalence of primary venereal disease. And it cannot be doubted that the care which was taken of diseased females must have tended to lessen venereal disease

amongst the natives. When, as was the case in Bombay, for instance, from 60 to 80 diseased women were in the Lock Hospital who would otherwise have been disseminating syphilis, such disease *must* be lessened. As the passing of Mr. Stanfield's motion by the House of Commons in 1883 was followed by an increase of venereal amongst the troops in England, so the abolition in 1888 by the House of Commons of the operation of the Contagious Diseases Act in India has been followed by an alarming increase of disease among the troops in that country. In the Sanitary Report on the Anglo-Indian Army for 1890, it is stated, "The admission-rate in the European Army in India for primary "venereal disease rose about 110 per mille above that of 1888.

The Presidency ratios per mille for venereal admissions stand as follows:—

TABLE XXIX.

—	1889.	1888.	1866.
Bengal - - -	491·2	390·6	217·7
Madras - - -	451·6	306·7	236-1
Bombay - - - -	481·1	291·6	—

The ratio of secondary syphilis has also been greatly increased, and the type of the disease has assumed a more virulent character. "This," as the "Times of India" recently observed, "stands to reason, "that where all sanitary control is thrown to the winds, the most "ignorant and reckless of their sex will take no trouble to look after "their health, and so the worst of diseases in its worst form is suffered "in cruel wantonness to multiply itself all over the Sudder Bazaars." More than this, a large amount of the fever which European soldiers suffer from in India is either much aggravated by the syphilitic taint or is purely syphilitic; for this fever may assume an intermittent, remittent, or continued form.

Similarly, much of the liver disease originates from syphllis. Neither is this all. There is a wide descending legacy of disease and degeneration affecting offspring, which gives to the subject an additional element of the greatest importance. It is therefore to be hoped that the Contagious Diseases Act may be again employed, and that there may be a prompt reversal of the policy imposed upon the House of Commons by certain misguided enthusiasts. I here quote a letter from a correspondent of the "Times of India," June 12th last, himself a soldier: "Day after day the evil increases; day after day the death "march wails over the victims of legislative imbecility, while the "triumphant intolerance of the bigot howls forth the never-ceasing "pæan, 'Thank God I am not as other men are.'" Having had the control of the Contagious Diseases Act in Bombay, when Surgeon-General, I have no hesitation in asserting that its abolition was calculated to produce more evil to the soldier than all the other sanitary measures in India can compensate for.

Among other matters demanding attention are the following: The Queen's Regulations for the Army state that no soldier shall be sent

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to the troipes until thoroughly drilled, but practically this is not the case. Again, principally as the result of the short service system, men are sent out too young. The Royal Commission on the Anglo-Indian Army long ago recommended that no soldier should be sent to India under 21 years of age. And the late Sanitary Commissioner with the Government of Bombay strenuously advised that the age should be 25. Other medical officers have also declaimed against the practice of sending very young men to the tropics. But, as a matter of fact, there are hundreds of soldiers in India of less than 19 years of age, and nearly 10,000 under the age of 23. Now, it is well known that a very large proportion of the sickness and mortality among soldiers in India has always occurred to young men. The records of the old East India Company's army show this. Statistics were certainly not so elaborate as regards the old Company's army as they are now. But the figures show that in the Company's army the mortality was 56 per 1,000 annually among men up to five years' service, eight less among men of 15 years' service, and 62 per mille among men of 20 years' service and upwards. Geddes, who wrote his "Clinical Illustrations of Disease in India," in 1846, remarked that "those having "the shortest period in the country, who were generally the youngest "soldiers, were the most liable to be attacked" by fever. Elaborate sanitary reports of the Anglo-Indian Army only date from 1864. But all through these reports there is the same refrain, viz., the excessive mortality among young soldiers. Thus, in one report it is stated, "the "number of men who break down in the first year of tropical service, "depends not only on the quality of the recruit at the time of enlist-"ment, but to a very considerable extent on age also." In another report it is stated, "from two to five years is the time during which "the largest number of men break down." In the report for 1870 there are these words: "Nearly one-third of the invaliding of the last "six years has been men of less than three years' service." Moreover, the sickness and mortality of newly-arrived regiments have been double what they were in old regiments quartered in the same station. In another report it is mentioned that the mortality during the first years of residence is higher than for some time subsequently. In the report for 1888 it is stated that 76 per cent. of the total number of deaths occurred to soldiers under five years' service. Many similar observations might be quoted, made not only by Indian sanitary authorities, but also by other independent observers.

Among the principal causes of sickness and mortality of young soldiers in India is fever. In 1888, fever constituted nearly 26 per cent. of the death-rate. According to many medical officers enteric or typhoid fever destroys most lives. And it has been stated that enteric fever was unknown in India until comparatively recent years. Other medical officers, however, hold that the fevers now prevalent in India have always prevailed. This little *quæstio vexata* may be left to medical experts. Because whatever term, under an improved system of nomenclature, may be accorded to the fevers of the present, the facts remain that fevers have always caused much mortality among young soldiers in India, and that as the mortality from so-called enteric fever

rose the mortality from other kinds of fever decreased. This mortality has always stood in definite relation with age and length of service. The average mortality of young soldiers from fever of all kinds, for the 11 years ending 1870, was 3·80 per mille. From 1870, when enteric fever first appears in the reports, to 1879 inclusive, the mortality averaged 2·28 per 1,000 annually for enteric, and 1·74 for other fevers. For the years 1879–86, the figures are, enteric 3·45, other fevers 0·93 per mille. So that practically there is merely a fractional increase of mortality since the era of enteric fever. This increase may certainly be explained by the fact that more than 76 per cent. of soldiers serving in India are young men, under 25 years of age, of not more than five years' service in the army, and of still less in the Indian Army.

Next, arrangements should be made for men to be sent first to hill stations, or at least to selected stations, instead of their being invariably sent to the station where the regiment they are to join happens to be. A more free use should be made of the hills, especially for working parties in the hot weather. But when Europeans go to the hills greater care in the way of warm clothing is required at once, fever or diarrhœa often resulting immediately from a mountain chill.

Some military stations have been abandoned as too unhealthy; but there are still some notoriously unhealthy, as there are notoriously unhealthy barracks and bungalows. Such should be abandoned at any cost. The standard barrack plan is, I think, rather a mistake, because no one plan of barrack or bungalow is suited to every varying climate of India. The climate demands modifications which have not been sufficiently considered, or at least authorised. Barrack-rooms should be so constructed as to admit of every man being partially screened from his neighbour. Over-ventilation is a most fertile cause of chill, and chill is a most fertile cause of disease. Over-ventilation should be guarded against as much as under-ventilation. Ventilation in barracks is often excessive. If the doors and windows are open the men sleep in a draught, if shut they breathe foul air. There should be small windows above each bed, and so protected that while the most thorough current is secured above, draught onto the bed is impossible. In some few stations better bungalows for officers have been provided, but much remains to be done under this head. Both surface and subsoil drainage in the neighbourhood of barracks, hospitals, and bungalows, demand more attention. For instance, roof-water is often supposed to be collected in iron vessels or chunamed pits, but the wind continually blows it into the adjacent ground, and the receptacles often run over. It has been stated that the dry-earth system of conservancy is in use, but men often neglect to use the earth, which should be insisted upon, or self-acting hoppers should be supplied. In localities where the natives will not yet use human ordure as manure, the mass is conveyed to some secluded spot and deposited in pits, which is manifestly wrong. In other localities it is buried in trenches, the ground being afterwards ploughed and sown. As before observed, it has been frequently advanced that by this wholesale disposal of fæcal matter germs of disease may be placed in the soil to be afterwards liberated. In my

opinion a mixture of ashes, charcoal, and lime is superior to dry earth, and would tend to destroy any germs present.

Plunge baths have been liberally provided, but more strict orders should be enforced against men staying in the bath too long, which is frequently followed by fever or liver affection. Also, it should be insisted upon that men wash more thoroughly, for some do not wash the lower parts of their body for days. A regimental wash-house for clothing should be provided, and native washermen should not be permitted to take clothing to their houses in the bazaars. Natives of India from experience know the value of the "cummerbund" (a cloth worn round the loins and bowels), and wearing a flannel belt over the whole of the abdomen and loins should be made obligatory; for a congested kidney is, I believe, not infrequently a cause of fever, and an abdominal chill may certainly be the immediate exciting cause of diarrhœa, dysentery, or even cholera. Arrangements should be made for men to have a change of clothing when coming in perspiring from parade or exercise, instead of allowing the clothes to dry on the body, oftentimes in a draught. The soldier's meals require some modification. Provision should be made for a better evening meal, and a less heavy dinner in the heat of the day. Natives never eat by choice in the heat of the day, and those who use meat take less of it in the hot season, an example which should be followed by the Europeans. A free ration should be given in the early morning of bread or biscuit, tea, cocoa, or still better coffee, which is both stimulating and antiperiodic. The temperature rises after food, although only in a small degree. An early morning meal was formerly supposed, in some mysterious manner, to prevent the deleterious influence of malaria. But I say that the benefit resulting from the practice of taking some nourishment before going out in the early morning is consequent on its rendering the system less liable to be affected by the fresh and comparatively chilly morning air.

The men should not be allowed to supplement their rations with bazaar pork, for a condition resembling typhoid may be caused by the flesh-worm which pork sometimes contains. It would be well if a bread making-machine were universally used, instead of the unwashed hands of natives. Typhoid has been attributed to the milk. This, however, may be doubted, for the women and children who consume most milk do not suffer so much from this disease as the men. Unless Government were to take the milk supply into their own hands, I do not see what more can be done to secure good milk than is already accomplished. A scorbutic taint is common, often regarded as malarious cachexia, and this points to the desirability of double rations of green vegetables whenever possible. The jurisdiction of the military commandant does not extend, at some stations, far from the cantonment. He should have control, for a radius of at least two miles, over every village and bazaar.

All the above is to be accomplished by authority, but classes for instruction in hygiene should be formed in every regiment or station. Men and officers should be taught how to take care of themselves. They should be taught the danger of unnecessary exposure to the sun,

and to take the greatest care to protect the body from comparative cold and damp, which, especially in the form of colder nigh air, dew, drenching rain, and sudden changes of temperature, acting on a skin much excited and consequently debilitated by heat and perspiration, constitutes, if not the dreaded malaria, an influence quite as injurious.

Lastly, I think the station hospital system is a mistake. The soldier, and particularly the young soldier, should have the medical officer's eyes constantly upon him. And this is not possible, unless there are regimental medical officers. In India especially, early attention to slight ailments is required. An attack of fever, or of other maladies may sometimes be prevented. But soldiers will not apply to station hospitals, with the freedom that they did to regimental hospitals.

In conclusion, I venture to reiterate a proposal, and the reasons for such proposal, already brought forward in the "British Medical Journal," and in the last number of the "Asiatic Quarterly Review." The mortality of young soldiers has already been referred to. But under conditions of climate exactly similar, men, by reason of their different temperaments and constitutions, suffer in very varying manners. Some individuals feel tropical heat intensely, while others seem scarcely annoyed thereby. There are some who suffer acutely from insomnia, consequent on the heat, the noises, and the nuisances of the tropical night; and there are others who keep well under almost any disturbing influences. Some people flourish and grow fat in the tropics (not, however, always a sign of health), while others grow pallid, weak, and thin. Some seem malaria proof; others are constantly suffering from more or less severe attacks of malarial fever. In short, there are some individuals who enjoy life and flourish in a tropical climate, at least for a time, who like the life, and who would be willing to remain if sufficient inducement were offered. Doubtless these people are to some extent the survival of the fittest; and they may be credited with more than the average *vis vitæ*, with prudence in life, with acquired knowledge of how to take care of themselves in the different circumstances in which they may be placed, and with freedom from disease. These are precisely the men required as soldiers in India; and these are the men who are so frequently sent home as time-expired soldiers, or when their regiments receive the order for Europe. What I venture to suggest as a tentative measure, is the formation of one European regiment in each Presidency for prolonged service in India. Into these regiments only men fitted as above sketched should be admitted, their period of service to extend until they became, from any cause, unfitted for duty. It should be recollected, that even in the tropics, some men are as young, physically and mentally, as others 10 years less in age. Free concessions should be made in the matters of pay, pension, and furlough. Any extra expenditure would certainly be more than counterbalanced by greater freedom from sickness, the loss of service involved for every soldier attacked by a bad form of fever averaging six months before he is fit for full duty. The diminished death-rate would also save a large sum, calculated at nearly 200*l.*, which every man who dies costs the State. There would be a lessened expenditure in the item of conveying invalids to Europe,

and bringing, to supply their places, immature youths, many of whom in their turn, have to be sent home at an early period of Indian service.

It now remains to state my conviction that the labours of the Indian Sanitary Department have equalled the best work in any country. In his address as President of the Department of Public Health at the Social Science Congress at Plymouth, 1881, Dr. Acland observed what a splendid training India now affords for raising a superior class of sanitary officers for the mother country, as India has already done in other departments of the public service.

In conclusion, I have to express my thanks to Mr. H. Hill, Statistical Department, India Office, for affording me access to various reports and documents; also to the sanitary officers in India, who so kindly answered the various questions submitted to them.

APPENDIX.

The principal improvements effected in each year in the different Provinces.

After the appointment of sanitary officials, the principal work for some time consisted in collecting information regarding the medical topography of towns and villages, and of the country generally. It would not, however, in a paper of this description, be just to the memory of those—chiefly medical officers—who had long before interested themselves in making such reports, unless their labours were mentioned. I therefore enumerate the following:—Sir Ranald Martin "On the topography of Calcutta," 1837; "Ajmere," by Dr. Irving; "Agra and Futtepoor Sekree," by Dr. John Murray; "Assam," by Dr. McCosh; "Dacca," by Dr. Taylor; "Kumaon," by Dr. Dollard; "Meerut," by Dr. J. Murray; "Upper Sind," by Dr. J. Kirk; "Sarun," by Dr. Ranking. All the above were published by order of Government. "The Plain of the Indus," by Dr. Lord (*Med. and Phy. Soc. Trans. Beng.*, Vol. VIII.); "Topography of the Valley of Peshawur" (*Indian Annals of Medical Science*, Vol. III.), "Sukkur and Tatta," by Dr. Don, (*Bom. Med. and Phy. Soc. Trans.*, No. 1); "Guzerat," by Dr. Gibson; "Belgaum," by Dr. Waller; "Sholapur," by Dr. Sylvester; "Sattara," by Dr. Wiehe; "Doolia," by Dr. Mackenzie; "Beloochistan," by Dr. Cook; "Kutch Bhooj," and "Mount Aboo," by the author; all in the Bombay Medical and Physical Society's transactions.

All these were now supplemented by the systematic reports of the sanitary officials, and the following affords a glance at the commencement and progress of actual sanitary work in the different provinces.

Bengal.

1855.—The first sanitary project I find on record for Bengal dates in 1855, when Mr. Clarke submitted a scheme for the underground drainage of Calcutta, estimated to cost Rs. 3,418,000. This was reported upon favourably by a systematic committee.

1859.—Mr. Clarke's drainage scheme actually commenced.

1862.—The drainage works in progress inspected by a committee and approved.

1864.—Drains that had been blocked up for years were opened. More than two-and-a-half millions of cubic feet of earth and accumulated débris were removed. Measures were taken for the erection of public necessaries and for the better disposal of night-soil. Markets were improved. The Hindu burning ghat was improved,

1865.—A series of questions were submitted to all medical officers in Bengal, requiring particulars as to the prevalence of disease, food of the people, geology, water-supply, sanitary defects, &c. A memorandum was circulated laying down the principles to be observed in laying out new villages at railway stations or elsewhere.

1866.—Great attention paid to the condition of water tanks in Calcutta. Tank in Amherst Square re-excavated. Blacquire's tank re-excavated after having been forgotten half a century.

1867. Works for the supply of water to Calcutta commenced. The water was to be taken from the Hooghly in the Pallah reach of the river, about two miles above Barrackpoor, and conveyed by pipes 42 inches in diameter to Tullah reservoir, to be formed to hold 1,000,000 gallons. Another tank proposed at Wellington Square to hold 6,000,000 gallons. Main nearly 12¾ miles long. Estimated cost Rs. 65,16,000. A municipal railway undertaken to remove sweepings from Calcutta, to be eight miles long. A square mile of land reclaimed from the Salt Lake. Methters compelled to adopt closed vessels for removal of night soil; and reorganisation of the night-soil department. A cinerator established at Dhappa for the disposal of carcases of dogs, offal, &c., so that such matters should not be thrown into the river. Four new public latrines opened.

1868.—The progress of Mr. Clarke's drainage works again inspected, and reported favourably on.

1869.—At the close of 1869, the Calcutta water-works were so far completed as to admit of supply to a large part of the city. Closure of five cemeteries in the town. At this period the board of justices asserted that any person who had been absent from Calcutta for a few years would, on his return, be struck with the improved appearance and sanitary condition of all the southern portion of the city.

1870.—Many matters of importance received the attention of the Calcutta municipality, such as complicated questions regarding taking over the water-supply from the contractor, discussing byelaws for the regulation of the water-supply, and amendment of the Municipal Act relating to water-supply. Also the extension of the daily supply, street tramways, and working the municipal line of rail. During this year the outfall drainage works were completed.

1871.—A resolution was passed that Mr. Clarke's drainage scheme, having proved a complete success in the areas brought under operation, steps should be taken to push on the completion, and Government asked for a loan for that purpose, the works having already cost half a million. A Bill to provide for the drainage of the Hoogley and Burdwan districts was passed this year. At this time the following were noted as the principal sanitary improvements in Calcutta:—The introduction of a water-supply, cessation of the practice of throwing night-soil into the river, the establishment of sewage depôts in connexion with the new drainage, the suppression of private mehter depôts, the stopping of throwing carcases and offal into the river, the establishment for the disposal of carcases at Salt Water Lake, the increase of public necessaries, the conversion of ordinary latrines into water latrines, reclamation of marsh lands at Salt Water Lake, slaughter-houses and bazaars placed under strict surveillance, the establishment of one public slaughter-house under municipal control. And the following results were noted:—

Years.	Deaths from Zymotic Diseases.	Deaths from Cholera.
1865 - -	18,637	5,076
1866 - -	15,970	6,823
1867 - -	8,709	2,268
1868 - -	10,308	4,178
1869 - -	9,471	3,592
1870 - -	7,010	1,563
1871 - -	6,741	800

1872.—Proposed to increase engine-power at Tullah, and to provide a rise at Tullah to increase the supply of water to Calcutta. A committee of expert engineers reported in favour of extension of the drainage works to the northern part of the town, estimated to cost Rs. 56,08,148. This being beyond the powers of the municipality, the commencement of first and second-class sewers was sanctioned, at an estimated cost of Rs. 1,820,242. It is worthy of remark that 12 streets and lanes were sewered on petition from the inhabitants. A new municipal market making progress. Partial drainage of a large swamp in the Bonorah district.

1873.—Sewerage of Calcutta making rapid progress. Embankment of the river frontage of the Hooghly, to prevent the deposit of filth. A canal made to connect the Damoodah river with the Banka; the latter river, flowing through the town of Burdwan, was at once the main sewer and chief source of water-supply, but when the waters of the Damoodah were allowed to flow in, the sluggish Banka became rapid and clean. An ancient weir was reconstructed at the east part of the town, and above this point there is now a clean, broad stream, from which it was proposed to draw water for distribution. Another great undertaking was the opening of the Kana Nuddee, which had been closed 30 years before by a zemindar. The opening of the stream gave fair water to a large extent of country.

1874.—Great advances in the sanitation of Dacca, Patna, Durbhunga, and Chittagong.

1875.—Act passed by the Government of Bengal for the punishment of anyone altering or obstructing any canal or drainage work, or corrupting or fouling the water of canals, wells, &c. Special attention given to improvement of water tanks at Hooghly and Chinsurah. A new burning ghat, constructed at Dacca at the expense of Baboo Govind Chunder Datt. Khajah Abdool Gunny gave 10,000*l.* for the construction of waterworks and 5,000*l.* for maintenance. Drainage of Bogra town commenced.

1876.—The Calcutta municipality obtained a loan for extension of waterworks. A health officer appointed to the Port of Calcutta, whose duties were to supervise the sanitary condition of the port; to board vessels arriving in port with infectious diseases, to inquire into disease among the shipping, and into the sanitary condition of vessels; to inspect pilgrim vessels, and to grant certificates of health. Much done for Chittagong; steps taken for waterworks; in the meantime, ten tanks set apart for drinking, and precautions taken to prevent pollution; surveys made with view to drainage; old burial grounds closed. Burning ghat fenced in, special hospital for infectious diseases established, 20 public latrines erected, thorough cleansing of town undertaken. In the Tipperah district several new tanks dug, and a canal cut through a jheel to the N.W., which will drain it. Swamp at Patna converted into a public garden by excavating the earth and raising the surrounding level, streets opened out at Durbhunga.

1877.—Useful sanitary improvements going on at the port of Calcutta; shipping supplied with water from boats fitted with iron tanks and pumps. Drainage in Hoogly and Midnapoor; Berhampoor supplied with nine public latrines; a ditch 1,500 ft. by 50 ft. reclaimed; Bogra drainage completed; drainage works at Darjeeling finished; drainage of Raipoor swamp completed; progress with water-works at Dacca; reclamation of a swamp at Patna; Kishengunje bazaar improved; conservancy established at Pooree.

1878.—Many improvements were effected during the year in the sanitary condition of the Hoogley river. The embanking of the filthy foreshore at Nimtolla was completed, thus putting a stop to the accumulation of animal and vegetable refuse at that point. All the main roads in Calcutta have now been provided with brick sewers to the total length of 48·93 miles, and the streets and byeways have been served with pipes to the extent of 94·64 miles, making a total length of sewers completed this year of 139·35 miles. The water-supply of Calcutta at this period was 8½ millions of gallons *per diem*, of which 6¾ millions was filtered, the latter increased during the year to 7½ millions. Much sanitary work was

also done in the "bustees," or small detached villages in the neighbourhood of Calcutta.

In Rungpoor town a drainage scheme under which extensive swamps in and around the civil station will be drained was partially carried out. In Barripoor and Barrackpoor, the drainage was much improved. At the Sydabad portion of Berhampoor town, masonry drains were constructed. At Pubnu a bund was made across the Ischamuttee river to afford a good supply of drinking water. In Dacca, waterworks of an extensive character were opened. At Patna conservancy and drainage were improved. Similarly at Cattack and Pooree.

1879.—In Calcutta the different works in progress for the improvement of the city were carried on with unabated energy. The municipality sanctioned Rs. 3,78,165 for the construction of new sewers aggregating in length 4·32 miles. New roads were made, running chiefly through the "bustees," which were thus made more accessible to the conservancy department. An extension of the water-supply was commenced. At Runpoor the efforts to improve the drainage were continued. Although it does not appear that any other very extensive sanitary works were carried out in Bengal during the year, there is ample evidence that in many places the municipal authorities effected marked improvements of a minor character.

1880.—The chief sanitary improvements in Calcutta, were the continuance of the drainage and water-supply extensions. The work commenced in 1878 for the supply of Barrackpoor with water was completed. Much was done to improve the sanitary condition of the port. At Burdwan a scheme for supplying the town from the Damuda river was in progress. At Dinagepoor the drainage scheme was nearly completed. The Senchal waterworks for Darjeeling were completed. At Patna, tramway latrines were brought into use. The latrine consists of a portable privy, moving on wheels, having for its object the immediate and permanent deodorisation of the night soil.

1881.—The following were projected or undertaken during the year. Further development of the water-supply of Calcutta, the Bengal Government promising a grant of Rs. 1,70,000; the Eden Canal project for supplying water to Burdwan and Hooghley was finished; extension of the Dacca water-works; the Dinagepoor drainage scheme completed; improvements in the drainage of Darjeeling and Gya.

1882.—The sanitary condition of Calcutta received much attention, including the extension of the water-supply, filtered and unfiltered; the progress of the sewerage system; the improvement of the town privies, and of the arrangements for removing night-soil; the reclamation of ground near "bustees"; and the obliteration of foul tanks. At the port, the condition of the Calcutta foreshore was further improved by the construction of suitable latrines and by the posting of a police guard. In several towns systematic drainage schemes were inaugurated, and either wholly or partially completed; among the latter being the great drainage scheme for Lalbagh. Drainage improvements were also in progress in the Nuddea district, one of which embraced an area of 20 miles long and one mile wide. The town of Chittagong was much benefited by the clearance of neighbouring jungle.

1883.—Among the improvements effected in Calcutta, was an increase in the filtered water-supply from a daily average of 7,868,062 to 7,975,960 gallons, and during the hot weather to a daily average of 8½ million gallons. There was also an increase in the daily supply of unfiltered from 1,988,175 to 2,035,808 gallons. The drainage system of the town was advanced. Improvements were made in the water-supply of Berhampoor, Dacca, Bagar, and Kurseong. Progress was made with the Cuttack drainage scheme. Further improvements were effected in the drainage of the Nuddea district.

1884.—Supply of filtered water in Calcutta increased to 8,207,330 gallons daily. The sewerage of the town almost completed, tank and well filling, and the construction of bathing platforms pushed on with energy. In the Bengal districts the most important work was the completion of the Burdwan water-works. In Dacca, further improvements were made

in the filter beds, and the water-works were extended northwards. Bhagulpoor water-works were carried on. Drainage works for Moorshedabad city were completed. At Patna, steps were taken to prevent rainfall stagnating by a system of surface drains.

1885.—Much attention given to the reclamation and improvement of Calcutta bustees. Forty-one more bathing platforms were completed. Works were in progress for improving the supply of filtered water to the city. The supply of unfiltered water was increased. The drainage works were virtually completed, the only part unfinished being a small area in Baug Bazaar and Hastings ward. In the Bengal districts the Burdwan water-works were completed. Much was done to improve the drainage of Midnapoor, and the district of Supai. In many other towns and districts important drainage works were actively carried on.

1886.—Considerable extensions carried out in the water-works of Darjeeling. A water-supply scheme was brought into use at Jamalpoor, and in Monghyr. The Bhagulpur water-works were in progress. A scheme for supplying the town of Puri with good water was submitted for sanction. A malarious swamp to the east of the Hazaribagh jail was converted into a lake by prison labour. In the town of Pubna, the water of the Ichamuttee river was protected by means of embankments and bridges. Various measures were adopted during the year to improve the water supply in parts of the Burdwan, Jessore, Rayshahye, and Southal districts. The embankment protecting the town of Nuddea from inundation was improved. Various improvements were effected in the drainage of Bettial, Berhampoor, Rungpoor, and Darjeeling. The drainage canal in the Purnea district, taken in hand in 1884, was completed. In Midnapoor and Cuttack districts, drainage canals were in progress.

1887.—In Calcutta improvements in bustees, tank filling, and bathing platforms were the principal measures. But filtered water was increased to 10,330,525 gallons, and unfiltered to 2,501,830 gallons daily. The Hastings supplementary drainage scheme completed. No great sanitary schemes were commenced in the district, but progress was made in all under operation.

1888.—The most important event was the commencement of works for doubling the Calcutta water-supply at a cost of Rs. 61,75,000. The existing works took 10 years to accomplish. In 1885–86 the daily supply of filtered water was limited to 8,106,000 gallons, it now exceeds 16,500,000 gallons. The daily supply per head amounts to 40 gallons of filtered and 7½ gallons of unfiltered water. Satisfactory progress made in the improvement of bustees. The chief drainage works was connected with the Baug Bazaar. In the districts there was the commencement of Dinagepoor drainage. The municipalities spent 51 per cent. of income on sanitation.

1889.—Extension of the waterworks at Dacca and Bhagulpoor.

1890.—Extension of the water-supply of Calcutta.

Madras.

1865.—A detailed report on the condition of the city of Madras was submitted to the Government of Madras. Vigorous action was taken to remedy defects. It was proposed to bring water from the Cortiliar river, and a complete system of drainage was planned by Captain Tulloch, R.E., who was sent to England to complete his project. Madras Municipal Act passed.

1868.—A scheme for the water-supply of Madras was finally adopted, viz., to bring water from the Red Hills Lake to some central spot at as high a level as possible, and to conduct it under pressure to fountains, &c. Captain Tulloch's drainage scheme was still in abeyance. A report on the drainage of Ootocamund was submitted. Sanitary progress throughout the country generally had been confined to the larger towns coming under the Municipal Act of 1865. In these towns material advance had been made. A system for the removal of all refuse from

streets and dwellings had been more or less enforced, surface drainage improved, latrines built to prevent defilement of waste spots, sources of water-supply inspected, and set apart for different purposes, the purest being kept for domestic use. In some towns old fortifications had been removed, and moats or ditches filled up. Streets had been widened, blind alleys opened out, and ventilation improved; periodical whitewashing of houses had been enforced, and disinfection insisted upon in dwellings where deaths had occurred from infectious disorders. A sewage farm established near Madras.

1869.—Communication between the Coum river and the Madras fort ditch cut off, and steps taken to admit the sea water at spring tides. Waterworks for the supply of the town of Trimulgherry commenced. At Cochin water tanks provided to catch roof water.

1870.—The municipal authorities of Madras engaged in laying pipes from the Red Hill reservoir. A cinerator constructed for the reduction of rubbish. At Conjeveram, owing to the representations of the sanitary commissioner, Surgeon-general Cornish, C.I.E., sanction was obtained to restore some ancient waterworks. At Kuddapah, Kurool, and Coconadas, measures taken for improvement in the water-supply.

1871.—A model "patcherry" laid out as a commencement to reclaim the pariah villages, many of which existed in the 28 square miles covered by Madras and its suburbs. Conjeveram bund repaired. A filthy tank within the temple limits of Madura cleaned. The water-supply of Bangalore town under consideration. Waterworks at Masulipatam commenced. Ulsoors village, near Bangalore, drained.

1872.—The experimental farms established near Madras in 1868, with the view of testing if sewage could be inoffensively utilised with success, reported upon favourably. Town supplied with Red Hill water; 87 fountains in public use.

1873.—Water-supply of Madras almost completed. Water-supply works for Tuticorin and Nellore instituted. Scheme of drainage for Madras by Mr. Clarke estimated to cost 131,207*l.*

1874, 1875.—No work of importance.

1876.—Sewage farm further developed. From failure of the monsoon the Red Hill water-supply ran short.

1877.—No sanitary work of importance.

1878.—No special work was completed this year, but 40·1 per cent. of the net income of the municipalities, amounting to 70,535*l.*, was expended in conservancy, cleansing, improving watercourses, and drainage.

1879.—The Sanitary Commissioner for Madras, in his summary of the sanitary works of the year, reported that no new works of any importance were executed in any part of the Presidency, but that the conservancy arrangements in most of the towns are all that could be required.

1880.—Drainage of part of the Black Town of Madras was completed, as an experimental measure. No new sanitary works of any importance were executed in the districts.

1881.—The work consisted this year, in most of the Madras circles, in the sinking and cleansing of wells, the digging of tanks, the construction of latrines, and the improvement of village sites.

1882.—In Madras good work was done by diverting foul drains which had hitherto emptied into the River Cooum. The drainage scheme for Black Town was proceeded with. An extension of the south main drain to the sea, near the Fort, was nearly completed. Extension of water supply was carried out in certain divisions of the city, and the supply extended from the Red Hills Lake. No sanitary work of great importance was carried out in other parts of the Madras Presidency, but great attention was given to the cleansing and repairing of the sources of water

supplies, also to drainage and conservancy. At Nagapatam revenue was apportioned for the construction of artesian wells.

1883.—Great progress was made in the drainage of Black Town. The pump and engine-house at Royapuram, the outfall channel, and the masonry weir, also one of the main sewers, were practically completed. Further progress was made in the work of diverting drains from the Cooum. An extension of the water-supply was completed, at an expenditure of 26,000*l*. Pipes of various sizes, extending over 28 miles, were fixed, besides 170 valves, 463 hydrants, 178 fountains, and 27 silt traps. In the Madras district there was no sanitary work of great importance, but about 49,000*l*. was spent in conservancy and minor works.

1884.—The water-supply of Madras seriously affected by a cyclone, which completely breached the Red Hill reservoir. Advantage was taken of the low level of the water to commence an offtake tower as part of a new water-supply scheme. Extension of existing water-supply was carried out in other parts of the town. The Black Town drainage made progress, and the pumping station at Royapuram was opened. In the diversion of drains from the Cooum, a plot of land 22 acres in extent was purchased and levelled to serve as a sewage farm for the disposal of the contents of a large drain which flowed into the Cooum. In other parts of the Madras Presidency the sanitary work of the year consisted chiefly in repairing and cleansing tanks and wells, and in the construction of latrines, drains, and roads, and in improving village sites.

1885.—Black Town drainage continued. The Red Hill reservoir restored. In the districts no sanitary work of magnitude was completed during the year.

1886.—No works of importance undertaken or executed, but various improvements of a minor nature carried out.

1887.—One lakh and a quarter expended on the Black Town drainage. A new sewer made in the Broadway. Seventeen miles of drains constructed. In the districts no new work executed, but water-supply schemes in preparation for Madura, Salem, Negapatam, and Kumbakonan.

1888.—Within Madras municipal limits 10 miles of drains of different sizes constructed. Considerable addition made to the water-supply system. No new sanitary work of magnitude in the districts.

1889.—Water scheme for Trinchinopoly prepared. Formation of a sanitary board by the appointment of a sanitary engineer.

Bombay.

1845.—Owing to a deficiency of water, which was all supplied from wells and tanks, Drs. Graham and Leith were deputed to consider the subject. They recommended that some private wells should be purchased, that the wells on the esplanade where cattle were watered should be reserved for the people, and that new wells should be sunk. But Mr. Rivett-Carnac pointed out that it was hopeless to obtain a sufficient supply from wells, the only plan being to collect a supply during the monsoon, the principal desiderata being an elevated position for a reservoir and a large collecting surface. Then Col. Jervis, chief engineer, recommended the construction of three reservoirs in situations affording sandstone strata which are saturated with water during the monsoon.

1846.—Colonel Crawton suggested the interception of a stream near Coorla, which rose from Vehar by a series of reservoirs, from which water might be pumped and distributed by iron pipes. Nothing however appears to have been done.

1851.—Lieut. De Lisle proposed to construct a reservoir at Vehar, at a cost of 12 lakhs of rupees. Mr. Conybeare reported favourably of this project, which ultimately grew into the present water-supply of Bombay.

1856.—The Vehar lake was commenced. It was to cover an area of 1,400 acres, with a gathering ground of 2,550 acres, and to be formed by three dams. Water was to be conveyed by a line of pipes 14 miles long, and calculated to give 8,000,000 gallons a day. This lake cost 56½ lakhs of rupees.

1861.—Colonel Tracy submitted a scheme for the drainage and sewerage of Bombay. The Vehar lake not being sufficient, and Bombay being entirely dependent on one supply, Mr. Aitken submitted four supplementary schemes. A committee was appointed to consider them.

1863.—The duties performed were mainly of a consultative nature.

1864.—The Government of Bombay directed the attention of local officials to the sanitary improvement of Poona and other cities.

1865.—Government of Bombay passed the "Bombay Municipal Act," and presented the municipality with a very valuable site at the end of the esplanade where the Crawford market now stands.

1866.—A careful survey was made of Bombay harbour, and a series of tidal experiments made, with the view of selecting an outfall for sewerage. Mr. Aitken submitted a scheme for the drainage and sewerage of Bombay. All the dipping wells were thoroughly cleansed and repaired. A fire brigade was established. Tanners were removed from the city. Early in the year the Health Department was formed under the new Municipal Act. It consisted of scavengering establishment, drain cleaners, road scrapers, market and slaughter-house custodians, a night-soil and hallalcore establishment. Garbage was conveyed 10 miles away, by cart and rail, to Coorla swamp; 54·96 miles of covered drains were opened, cleansed, and repaired, and progress was made in a main drain for the port.

1867.—A health officer was appointed for the port of Bombay. Slaughter-houses were built at Bandora. A foul offensive tank near the officers' quarters was filled in. The Elphinstone Land Company effected much good by covering filthy foreshore with some feet of earth, and building a sea wall. Sanction was given to the alteration of a portion of the fort sewers with the view of connexion with the Camatteepoora system. A main sewer and outfall at Soonapur were completed; and a low-level drain from Bellairs Road to Love Grove sluices finished.

1868.—Messrs. Sowerby, Rawlinson, and Tulloch submitted schemes for drainage and sewerage, the main features being the complete separation of drainage and sewerage. Several burial grounds were closed in Bombay. Sanitary improvements at Aboo, and drainage at Porrundhur mentioned.

1869.—A committee having reported favourably on the supplementary Toolsee waterworks scheme it was adopted. This was to increase the quantity of water in the Vehar lake by the construction of a dam across the river Tassoo, near the village of Toolsee, at an estimated cost of 16½ lakhs, including a second main from Vehar to Bombay. The health officer, Mr. Hewlett, submitted a project for the utilisation of night-soil by the manufacture of artificial manure, and Government sanctioned a small sum for an experiment. The desirability of providing houses of refuge when it became necessary to turn inhabitants out of their dwellings on account of cholera was considered. Sixteen burial grounds were closed during the year. Camateepoora drainage was nearly finished. Love Grove pumping station was enlarged. Sewage irrigation was commenced on a small scale near Love Grove. Captain Tulloch's drainage scheme mentioned under 1868 was deferred, a committee recommending that for the present the city should confine itself to improving surface drainage.

1870.—Captain Tulloch, R.E., was appointed executive engineer for Bombay city. Several stone and iron drinking fountains were erected, presented by Cowasjee Jehangir Readymoney, Esq., C.S.I. The Colaba Christian burial ground was closed.

The sanitary progress of Bombay up to this date may be stated as follows: Organisation of an efficient health department, which this year removed 116,127 tons of garbage, against 45,288 in 1865, an increase of 110 per cent. A complete hallalcore service organised, whereby 144 tons of night-soil were daily removed against 75 tons in 1865. All dangerous and offensive trades removed from the inhabited parts of the island. Slaughter-houses closed, and the operations carried on at Bandora. Entirely new markets built. Many burial grounds closed. The old main drain intercepted where it became an open cesspool, and its contents, carried by a low-level sewer, now discharged without cessation. The foul district of Cammateepoora and part of the fort sewered. Vehar water supplied to 9,643 houses, and 100 points open to the population where water may be obtained free. City lighted with gas. About 11 miles of new road constructed, and several handsome bridges built. The mortality had fallen gradually from 28,631 in 1865, to 14,888 in 1870, a reduction of 100 per cent., although the population had increased.

1871.—The Toolsee waterwork scheme improved upon by Mr. Walton, his project being to impound the water at such a height as to utilise the ridge of hills between Vehar and Tulsee, so that the surplus water, after the new reservoir became full, might pass into the Vehar Lake. No work of importance undertaken, excepting some repairs to the Vehar dam. Several new fountains preserved by private individuals for Bombay. Survey of Bombay completed. Works for irrigation and water-supply in progress at Kornckwasla and Pandharpur. Improvements noted at Aboo, and in the Sholapur conservancy.

1872.—The largest works carried on for the city of Bombay were the Graet Road drainage scheme, and the Toolsee Lake, the main dam being raised so far as to permit part of the rain-fall to pass into Vehar. The sewerage and drainage of Bombay was the subject of much discussion, especially by Mr. Pedder, the Municipal Commissioner, and Mr. Lumsdaine, the health officer. The conclusions arrived at were that sewerage and water should be separated; storm-water should be removed by gravitation, and night-soil removed by hand; but, instead of being carried in carts, to be put into sewers at collecting depôts. Love Grove sewage to be purified. During this year the surface conservancy at Kurracchee was described as now admirable, and that of Poona as fairly good.

1873.—An experimental system of drainage introduced into Sonapur. The feasibility of impounding water in the neighbouring hills for the supply of Tanna inquired into.

1874.—Proposal to construct another lake in the hills north-west of Vehar. During this year it was observed, "What may be said of few "cities in the world, may be said of Bombay, viz., that the streets in the "poorest part of the town are as regularly swept and are as clean, as "where rank and fashion dwell." Water-supply being provided for Poona.

1875.—Carnac night-soil depôt altered and improved. Pumping machinery at Love Grove increased. A grant from Government for the completion of the Tulsee Lake. New markets built at Mazagon. Fifty-eight streets widened in the city of Bombay.

1876.—This year it was decided that until the water-supply was more abundant, no radical change of the existing system of sewerage could be effected. The municipality were spending 360,000*l.* in increasing the water-supply, and 60,000*l.* in improving surface drainage. It was noted that the mortality of Bombay is considerably lower than that of Berlin, Vienna, and other cities of Europe and America. Waterworks given to Alibagh by the Bhow Sahib in honour of the Prince of Wales' visit. Waterworks for Penn and Kholapoor in progress.

1877.—A Special Commission appointed by Government to determine the best scheme of drainage for Bombay. Surgeon-General, now Sir Guyer Hunter, K.C.M.G., being President. Waterworks commenced at Jamkhundee.

1878.—The Drainage Commission's report presented in January, after much evidence had been taken. The Commission were of opinion that the separation of storm-water and sewage must be effected; also that, provided sewage were delivered not less than eight feet below low water mark, no injurious deposits on the shore would result; also that on both financial and sanitary grounds the utilisation of sewage for irrigation purposes, was not desirable on or near the island of Bombay. Briefly, the scheme consisted in the construction of a series of large drains which should carry off sewage to the western shore at Love Grove, to be then delivered by a powerful pumping apparatus into the sea in a locality where no harm would result. The old sewers to be utilised for storm-water only. The estimate was 600,000*l.*, including 100,000*l.* for additional water-works. This is now the drainage and sewerage system of Bombay.

1878. Woorlee sluices widened to 100 feet, and the outlet channel deepened to low-water spring tides, by which the sectional area of the sluices available for discharge was increased from 180 to 1,180 feet Great progress made in the construction of the new water-works at Tulsi and the distributing reservoir on Malabar Hill, the whole of the piping, a length of 18 miles, being laid. Important sanitary improvements in the way of filling up low-lying places were made during the year; an excellent drain was substituted for the open ditch on one side of the Coombharwadee. Among the most important improvements at other places in the Bombay districts, was a supply of water to Jalgaon, secured by the construction of a new tank at Merun. New drains were constructed, and steps taken to flush the main drains of the town from cisterns. Water-works commenced at Hyderabad, Sind.

1879.—In the Annual Sanitary Report of the Bombay Presidency a long list is furnished of the civil sanitary works of the year. The heavier items of expenditure were for the extension of the water-supply at Poona, Rs. 13,018; and waterworks at Hyderabad, Rs. 28,237. At Sholapur a new water-supply scheme was commenced.

1880.—The new drainage works in the city of Bombay were vigorously prosecuted, and surveys made for house connexions. The dam of the Tulsi lake was raised 6 feet. The Malabar Hill reservoir was completed. Progress was also made with a reservoir at Bunderwara. In other parts of the Presidency much good sanitary work was done. Progress was made with the Karachi waterworks. The municipality of Rutnaghiri obtained a loan of 3,000*l.* for improving the water supply. A large scheme for providing the town of Satara with good water was commenced. Water was introduced into the town of Mehda from a well by iron pipes. Waterworks for Sholapur nearly completed, and commenced for Chiplun.

1881.—Some important improvements were carried out in the water-works for Bombay. At Jalgaon water pipes were laid from the town to the old village. At Sholapur the construction of reservoirs and steam pumps far raising water were completed. At Vingorla and Chiplun the waterworks were enlarged. At Rajapur they were improved. At Rutnaghiri the waterworks were completed. At Kurrachee the water-works progressed steadily, and were to some extent utilised. At Tanna a considerable extent of marshy ground was reclaimed. At Ahmedabad, Ahmednagar, and Broach considerable sanitary work of a minor character was undertaken.

1882.—The most important sanitary measure initiated in Bombay during the year was a scheme of surface drainage, the object being to raise the level of the Khetwadi district and drain it, and to provide two large intercepting drains to carry off the storm waters into the large reservoir to be constructed on the flats. The drainage works and the reservoirs at Bunderwara and Malaba Hill progressed. A main sewer from Carnac Bridge to Love Grove was completed and connected with the old drain. The Queen's Road sewer, to intercept the drainage falling into Back Bay, and to convey it into the new system at Love Grove, was commenced, at an estimated cost of 19,200*l.* The drainage sewers in Camateepoora were nearly finished. Much work of a minor character was carried out in other parts of the Presidency.

1883.—Considerable progress made in measures for improving the water supply. New reservoirs on Malabar and Bhandarwada hills were completed, and the catch-water channels at Vehar and Tulsi for increasing the gathering ground were energetically pushed on. The drainage of the city was receiving careful attention. The Kas waterworks, for supplying the town of Satara were finished; also the new waterworks at Chiplun. The scheme for bringing the Mahi water to Kurrachee was drawing towards completion. At Admednagar, Nasick, and Sukkur, new drains were formed.

1884.—The construction of the catchment channels on the slopes above the Vehar and Tulsi lakes were finished. The Bhandawara and Malabar Hill filter beds finished. The roofing of the latter reservoir was commenced, and the surface drainage to carry off storm water was nearly completed. No scheme of importance undertaken in other parts of the Bombay Presidency, but a good deal was done in improving the sanitary condition of localities, especially the drainage of Sukkur.

1885.—The Tansa water scheme progressed, several important drainage works being carried on. No other sanitary work of importance in the districts.

1886.—Waterworks at Roha, Ahmednuggur, and Talegaon in progress. At Broach Rs. 41,483 were expended in finishing and paving roads. At Surat Rs. 7,506 were spent in improving the Jedda Khari. At Ahmednuggur Rs. 24,852 were expended on sanitary works of various descriptions.

1890.—The Bombay Village Sanitation Act, No. 1 of 1889, received the assent of the Government of India, May 1890. The Bill provides for each village to have a sanitary committee or board, consisting of three or more residents of the village chosen by the collector. The sanitary committee to make rules from time to time for regulating terms of office of members, for cleansing streets, &c., for preserving an adequate supply of pure water, for preventing nuisances, &c., by imposing fines, and generally for giving effect in the village to the purposes of the Act. All offences against the rules made by the committee to be cognisable by the committee, the person convicted having the right of appeal to the district magistrate. The collector may also appoint a sanitary inspector for one or more villages, who shall take measures for preventing breaches of the rules in force by summoning offenders before the sanitary board.

1891.—The Tansa dam, the largest dam in existence, completed. Opening of the Ahmedabad waterworks by the Governor of Bombay.

North-West Provinces and Oude.

1864.—A memorandum on conservancy of towns and villages circulated.

1868.—It was said of Cawnpoor, that "the town had been purified to "an extent which no other city," the sanitary commissioner had seen, "could boast of."

1870.—A scheme for the drainage of Cawnpoor under consideration. Commencement of drainage for the Ganges and Jumna Doab districts.

1871.—Special inspection of the Saharunpoor district with reference to the relation of spleen disease and fever to irrigation. Drainage works at Saharumpoor, Cawnpoor, Mozaffurnuggur, Allahabad, Benares, and at Sultanpoor, Oude, much improved. It was observed that sanitary improvements are assuming an importance which will result in quite changing for the better the appearance of the cities.

1872.—Drainage of Saharunpoor and Mozaffanuggur districts in progress. Special works for surface drainage of Saharunpoor city. Reclamation of the Pandolee Nuddee. Improvement in the bed of the Damoolal Nuddee for a distance of eight miles, as far as its junction with the Hindun River. Road making in crowded parts of Benares. Improvements of drainage effected at Faizabad, Barra Banki, and Oonao in Oude.

In the cities and towns of the Province generally the work of sanitary improvement was growing with very considerable vigour.

1873.—In most municipalities great progress in draining and paving streets, &c.

1874.—Project of draining Saharunpur nearly completed, at a cost of 11,164*l*.

1875.—Meerut drainage scheme in active prosecution. Reclamation of four shallow stagnant ponds near Meerut. Kishapoor swamp reclaimed. At Sambhal a cutting seven miles long for drainage planned and partly executed. Cawnpoor drainage improved. Gorruckpoor drainage improved. At Benares two new roads 40 feet wide with drains and raised footpaths nearly finished.

1876.—In Kumaon and Ghurwall urgent endeavours to improve the sanitary condition of villages. Bareilly wells cleaned and slaughter-houses built. In Meerut district, work of draining the Upper Doab continued. Drainage of Meerut well advanced. A general system of drainage created in the town of Mynpoorie. At Mizapoor, the Kundwa Nullah was converted into a good drainage way. In Oude, experiments in drainage were undertaken in the Lucknow, Roy, Bareilly, Gonda, and Bara Banka districts. Reclamation of land at Gorakhpoor effected.

1877.—Considerable improvements were effected in Meerut, Saharunpoor, Bareilly, and Agra. The municipalities spent 35 per cent. of their incomes on conservancy, and 75 per cent. on works of general utility, principally sanitary. In the hill tracts, sanitary improvement effected by separating dwelling houses from cow-sheds. In Fyzabad, the water supply was improved.

1878.—In Kumaon and Gurhwal, the work of constructing cattle-sheds outside villages was carried on. Spring water was brought from a distance of three miles for the supply of Almora. Extensive improvements were effected in Shahjeanpoor city, by opening up some of the most crowded parts by a new roadway or boulevard, the planting of trees, and the improvement of drainage channels. In Saharunpoor district great sanitary improvements were effected in most of the towns, especially Roorkee. There every thoroughfare was lined on both sides by stone built drains, and a turbine driven by a fall of water from the Ganges canal, raised water to a height of 12½ feet to a masonry channel, providing a maximum supply of 24,000 gallons per hour, which was carried throughout the length and breadth of the town. In the Mozaffunuggur district, an offensive water-hole was converted in a fruit garden, and drainage and paving works were carried out in 15 towns. In Meerut, the drainage works were extended. Drainage cuttings were commenced or completed in the Bulandsharh district to a length of 36½ miles. In the Banda district instructions were issued calling upon the inhabitants to keep their refuse and manure heaps at a distance of at least 200 yards from villages, to remove all sweepings to these heaps daily, and to permit no nuisance within 200 yards of the village. Insanitary trades were not to be carried on within village limits, and strict cleanliness of all drinking wells was to be enforced. In Benares a new road was opened in a densely populated part of the city.

1879.—At Cawnpoor some important sanitary works were in progress, with the object of dealing with the drainage and sewerage of the town. It is stated that a marked success attended the efforts made to effect village sanitation in the Banda district.

1880.—No sanitary work of any magnitude was executed; but in almost every town, something in the way of sanitary improvement was effected, and a decided step was made as regards rural sanitation, in the districts of Meerut, Humipoor, Allahabad, Kheri, Sitapur, and Jhansi. Notice was given by the Collector of Hardoi, that for each Tahsil a committee would select the cleanest villages belonging to any landholder, who would receive a certificate, and whose name would be mentioned to Government.

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1881.—No sanitary work of magnitude executed during the year. But 13,509 feet of new drainage was made at Cawnpoor.

1882.—One of the most important works was the construction of a reservoir for the supply of water to Almora. At Shahjeanpoor new drains were constructed. One of the main channels for the drainage of Bareilly was completed. At Lucknow surface drainage was extended. At Cawnpoor drainage improvements were pushed on. At Bulandsharh a masonry embankment for the reclamation of low ground near the river was completed, and the drainage of the town was remodelled.

1883.—No special sanitary works of importance were undertaken, but many improvements were effected in roads, drainage, sources of water supply, conservancy, &c.

1884.—At Bareilly 2,600*l.* was expended in drainage. At Agimgarh and Gorakpoor important drainage operations were carried on. At Lucknow the water-supply scheme was completed.

1885.—Among the most important works were improvement of the water supply of Mussooree, and the construction of a permanent main drain to the south of the city of Meerut.

1886.—At Almorah an excellent water service and a public bathing tank provided. At Naini Tal projects in hand for improving the drainage and flushing the bazaar drains. At Moradabad repairing of roads and construction of drains. At Sambhal draining and metalling roads. At Bareilly Rs. 13,316 spent on drainage. At Shahjehanpur Rs. 18,570 expended on drains and latrines. At Agra Rs. 43,867 were laid out on sanitary works, including expenditure on artesian well operations. At Allahabad Rs. 77,436 were spent on sanitary works. At Benares, Mirzapoor, Gazepoor, Gorakhpur, Lucknow, Sitapur, Sandilla, Rae-Bareli, Fyzabad, and Bahraich large sums was spent on sanitary works.

1887.—In the town of Dera Dhoon waterworks were nearing completion. At Mussoorie an enlarged conservancy scheme was undertaken. At Saharunpoor a large sum was expended on minor drains, and in a scheme for effectually flushing them. At Farakabad Rs. 19,000 was expended on various sanitary improvements. The municipality of Moradabad spent Rs. 29,188 on sanitation, the principal work being the construction of a masonry drain from Doberia tank to the Ramganga. At Allahabad Rs. 78,603 were expended on sanitation, and 12 lakhs sanctioned for waterworks. At Ballia a drainage scheme was commenced, to facilitate the flow of water from the town during the rains. At Lucknow Rs. 67,422 were expended on the works. Another most important scheme was the drainage known as the "Karwan Nuddee Improvement," to relieve waterlogged tracts in the Muttra and Agra districts, at an estimated cost of Rs. 86,000.

1888.—At Dehra the supply of water from the Pani spring was accomplished. At Allahabad several drains were finished, and a scheme for the better conservancy of the city was in preparation. Plans and estimates for waterworks at a cost of Rs. 15,40,000 were prepared (since completed, and opened in 1891 by the present Viceroy). For Benares, water-supply and drainage schemes, to cost 40 lakhs were elaborated. At Lucknow progress was made in boring artesian wells. At Sultanpoor the main drainage of the town was under construction. At Fyzabad a scheme for water-supply was adopted.

1889.—Extension of water-supply at Almorah and Benares. Drainage at Benares. Projects for supplying Agra and Allahabad with filtered water from the Jumna put in hand. Many minor sanitary improvements effected.

1890.—The foundation stone of the Benares waterworks laid by H.R.H. Prince Albert Victor. The Agra waterworks opened by the Viceroy. Allahabad waterworks nearing completion. Benares drainage scheme and Cawnpoor waterworks under discussion. Schemes for the better sanitation of the hill stations of Mussoorie and Nynee Tal put forward.

1891.—Allahabad waterworks opened by the Viceroy.

PUNJAUB.

1864.—Conservancy regulations for towns and villages issued.

1868.—A careful investigation of beef-cysts, and their relation to the food of animals undertaken.

1870.—Sanitary improvements engaging much attention. For Amritsur project of drainage and water-supply under discussion. Projects for draining Ferozepoor and Jalundur, and for improving the water-supply of Kohat, Lahore, Rawul Pindee, Murree, and Peshawur, either actually commenced or decided upon.

1871.—Report by Dr. Fergusson on the relation of spleen disease to irrigation. Although no great sanitary work was commenced, much was being done in nearly every town; streets were being paved, drained and widened. Latrines were provided in most towns, and conservancy attended to. Noxious trades were being gradually removed from towns. Burial was no longer generally permitted within the walls of the towns. Pains had been taken to preserve the water-supplies from fouling. Registration of births and deaths improving in accuracy.

1873.—Much done in the way of paving and draining streets, cleansing, and repairing wells, filling hollows, and other minor work. Measures were taken to cause the municipalities to prepare comprehensive schemes of general sanitation, to be carried into effect as funds admitted, under the advice of the sanitary commissioner.

1874.—Only sanitary work of minor importance. An application from the municipality of Delhi for a loan from Government of 74,000*l.* for waterworks.

1875.—Project for water-supply for Lahore to cost 81,000*l.*, and for drainage to cost 20,000*l.* The Secretary of State sanctioned 100,000*l.* being spent on sanitary improvements at Simla. Rawul Pindee water scheme to cost 20,000*l.* prepared.

1876.—In the Sirsa district pillars erected 200 yards from villages, as limits to the deposit of garbage, manure, &c. Lahore water-supply, estimated at 130,000*l.* sanctioned. Drainage works at Jagroan, and Peshawur in progress.

1877.—Improvements in Gurgaon, Hissar, Hoshiapur, Shapur, and Simla. Lahore, Peshawur cantonment, and Simla waterworks in progress.

1878.—Considerable progress was made with the waterworks at Simla. All the works in connexion with the supply of water from the Bara river to the cantonment of Peshawur were completed. At Lahore 13 roads were entirely re-metalled, and the city drains improved by the construction of a large outfall sewer. In Hoshiapur, a large pond, known as the "Kacha Kila Toba," was filled in, and prevented being a receptacle for drainage and rubbish. At Umballa, drinking wells were cleaned and repaired.

1879.—The waterworks at Simla were so far completed as to admit of distribution all over the station. The waterworks of Lahore were actively pushed on. The large outfall sewer conducting the sewage of the city in an underground channel to a distance of four miles was completed. The drainage and sewerage of Amritsur was much advanced. Numerous other improvements of a minor nature were effected.

1880.—The most important sanitary works completed or in progress were the water-supply and drainage projects of Lahore, Simla, Amritsur, Delhi, Ludhiana, Kohat, and Hansi. Works for the improvement of the water-logged tracts of the Jullundur division, where the flow of the surface water in the rainy season was formerly arrested by the road and railway embankments, were carried out. The water-way along these embankments was largely extended, more especially on the line of railway. The new alignment of the Western Jumna canal (which had become necessary owing to the low

levels of the old channels by which the ground along their course had become thoroughly waterlogged, while the spring level had been brought to the surface) was put in hand.

1881.—The chief sanitary event was the completion of the Lahore waterworks. Preliminary works for water-supply and drainage at Delhi were in progress. At Amritsur the main drainage was nearly finished. In the Hoshiapur district three drainage schemes of a minor character were carried out. In Jullundur much was done to prevent the swamping of land near the city during the rains. In connexion with the water supply at Simla, orders were issued to construct the Sanjauli reservoir.

1882.—Much is reported to have been done in the way of minor sanitation, but no large work was commenced or completed.

1883.—In Lahore the new reservoir was approaching completion. Considerable improvements were effected in the drainage of Lahore. Amritsur water-supply scheme well advanced. Progress made in the extra-mural drainage of the same city. At Simla the Sanjauli reservoir approached completion. Drinking tanks were placed on several roads. At Georgegurh a large masonry tank was constructed to meet a deficient supply of water. The Peshawur municipality brought to completion a large project known as the city canal.

1884.—Sanjauli reservoir almost completed. Drainage of Simla proceeded with. Drainage at Amritsur almost finished. In suburbs of Delhi extra-mural drainage scheme commenced. At Dalhousie arrangements for drainage and water-supply for civil station. Cleansing of the Bara river at Peshawur. In addition, a great number of minor improvements effected.

1885.—Several important works executed, and others taken in hand. Among those completed were drainage works at Dera Gazee Khan, and the outfall channel at Amritsur. The ditch round the city of Amritsur was also being filled in. Projects undertaken were drainage of the city of Gujranwolla and the Rawul Pindee water scheme.

1886.—The main line of the Simla sewerage scheme was completed; also the extra-mural channel for drainage at Amritsur.

1887.—The Kallipur bund in the Gurgaon district making good progress. Filling up of Amritsur ditch progressing. Rawul Pindee waterworks scheme almost completed,

1888.—The sanitary works of importance on hand were the filling up of the Amritsur moat, the Gujranwolla drainage scheme, and outfall drains at Sialkote. In Jullundur and Ludhiana drainage was in progress. Peshawur drainage was improved, The Rawul Pindee waterworks completed. Several large projects were sanctioned, among them a conservancy tramway for the city of Delhi, a drainage scheme for the city of Ludhiana, and an improved water-supply scheme for Peshawur.

1890.—In Delhi the conservancy tramway was completed. The Delhi waterworks scheme well advanced. A drainage project for Tampat in the Kurnal district put in hand. The water-supply project of Kalka was completed. In Dhurmsala iron piping for supply of drinking water at the McLeod gury was laid down. In Jullundur the extra-mural drainage scheme was nearly completed. A drainage scheme for Bungah completed. The Ludhiana drainage project in progress. Extra-mural drainage of Gujranwolla finished. A water-supply project at Abbottabad well advanced. Peshawur water-supply scheme approaching completion.

Central Provinces.

1869.—Registration of vital statistics commenced.

1870.—Considerable improvement in minor works during previous years. This year improvements in conservancy and drainage of several

large towns. At Nagpoor waterworks actively in progress. At Soonce a waterworks scheme in execution. At Jubbulpoor and Sangor waterworks under discussion. A return forwarded, showing the water-supply in every town and village, and the defects.

1871.—Improvements effected in many localities, and others in actual progress to completion.

1872.—At Nagpoor the waterworks were completed, supplying the whole city, excepting some high points, with good water from the Ambaghari reservoir.

1873.—Upwards of 4,000 new wells provided in the province. Grant from provincial revenue for the Seonce reservoir. Act XI. of 1873 passed, revising working of municipalities, and extending provisions.

1874.—Raipoor waterworks scheme put in hand.

1875.—No work of magnitude Nagpoor drainage improved. Drainage improved at Saugor and Chanda. Conservancy establishment brought into operation at Hoshinabad. The Porcina tank at Damoh excavated and deepened, and the drainage of the town much improved.

1876.—In Saugor and Damoh surface drainage was in progress. In Nagpoor the water-supply system was considerably extended. Much minor work was done at many other places.

1877.—Rules relating to the public health were supplied to every town and large village, and the heads of village communities were charged with the duty of seeing them carried out. Saugor Lake received much attention. Conservancy establishment formed for Damoh, also at Chindwarra. At Jubbulpoor a large tank formed.

1878.—In most of the districts money was expended by the people in improvements of water-supply, sinking wells, repairing tanks, and remedying local defects in drainage. The set of village conservancy rules was more widely disseminated, and the village head-men were charged with seeing them acted up to as far as possible. 409 new wells were provided, and 343 old ones repaired in 615 villages.

1879.—The sanitary commissioner was unable to report the execution of any works of magnitude, but that the municipalities were not idle is shown by his report.

1880.—Extensive waterworks at Jubbulpoor and Hinghanghat in progress. At Raipoor works for improving the water-supply made good progress.

1881.—The Jubbulpoor waterworks were proceeded with, and the Hinghanghat waterworks were nearly completed. At Saugor money was spent on the Kunera waterworks. In many places the sources of the water-supply were improved, and drains were constructed. The Land Revenue Act 18 of 1881 came into operation, affording further means by which sanitation could be carried out in rural districts.

1882.—The chief event of the year was the completion of the waterworks at Jubbulpoor. 226 new wells were sunk in the province during the year.

1883.—Completion of the waterworks at Hinghanghat. In most of the districts good work was done in providing better water by more new wells, in cleansing and repairing tanks, and in constructing roadside drains, &c.

1884.—The work of the year was of minor importance.

1885.—Minor extensions of water-supply, drainage and conservancy.

1886.—No large works of a sanitary nature undertaken. With a view to improve conservancy and water-supply, certain rules were framed under the Land Revenue Act.

1887.—No sanitary measure of any importance, except the construction of 185 new wells.

1888.—Village sanitation received much attention from village headmen, and the sanitary rules which at first were made applicable to villages within a few miles of head quarter stations, were extended to all villages having over 50 inhabitants.

1889.—Act 19 of 1889 for making better provision for the sanitation of villages was passed.

1890.—Extension of Nagpoor waterworks, scheme for waterworks for Berhampur in the Minar district, also at Raipur, Khandwa, and Wardha.

BERAR.

1870.—Berar was not placed under a sanitary official until 1870.

1872.—The attention given to conservancy and matters of public health increasing.

1873.—Work done but small.

1874.—Poverty a bar.

1875.—Poverty still pleaded, but minor drainage and conservancy attended to.

1876.—An obstacle mentioned, viz., the assessment of land so close to villages that there is no space for sanitary purposes.

1877.—Government of India called attention to a larger amount being allotted for sanitary purposes.

1878.—A great water tank at Shegoan was completed. At Yeotmal a tank was finished.

1879.—No sanitary works of importance were accomplished, the municipalities, with the limited means at their disposal, having been able to do little more than attend to the conservancy and cleansing of towns.

1880.—Want of funds prevented any new sanitary work of importance, but many minor improvements in the shape of wells, tanks, drains, latrines, &c. were effected at the expenditure of 37 per cent. of the total municipal incomes. A village code of sanitation introduced.

1881.—No work of magnitude. A tank at Akhatwara constructed by P. W. Department.

1882.—The most important works on hand were waterworks for Khamgaon and Amraoti. Steady progress made in the draining of the town of Khamgaon. Improvements in the drainage of Arkola.

1883.—Approaching completion of the Amraoti waterworks. In Ellichpoor district tanks were being constructed. Tanks and wells were also made in the Arkola and Buldam districts. The Wadali tank cost Rs. 10,890.

1884.—The expenditure incurred in sanitary improvements by the municipalities of Berar was 15,700*l*. The Kamgaon waterworks approached completion. It is noted that considerable improvement in village sanitation was effected. The Hirgowan tank cost Rs. 18,523.

1885.—The most important sanitary works were the completion of the two water-supply schemes mentioned above.

1886.—No sanitary work of any magnitude undertaken, except the construction of the Kaiapani tank, at a cost of Rs. 2,87,316.

1887.—No sanitary measure of any importance except the construction of 185 new wells and several new tanks.

1888.—The question of village sanitation received much attention from village head-men, and the special sanitary rules, which at first were made applicable to villages within a few miles' radius of head quarter stations, were extended to all villages having over 50 inhabitants. Increasing the capacity of the Kalapani and Wadali tanks were the chief works in progress.

1889.—Drainage at Muztinapoor; constructing river dam at Sendingana; laying water connexion to bungalows at Amraotee; extending waste weir at Janora tank; raising the bund of the Janora tank, were the principal improvements.

1890.—The chief works were constructing an anicut at Patoola, cost Rs. 4,581, and another at Chikalda, cost Rs. 28,665. Also extension of the Amraotee city waterworks, at a cost of Rs. 32,204.

Assam.

1874.—Nothing of importance appears to have been accomplished in Assam up to 1874; but it is noted that in the town areas of Assam, sanitary measures were being carried out to a certain extent; surface drainage was being attended to; the growth of jungle was kept down in the neighbourhood of villages; and filth and refuse were removed from the vicinity of dwellings. Gauhatti is especially mentioned as having been sanitarily much improved.

1878.—The drainage of Gauhati, and the reconstruction of the unhealthy bazaar at Dibrugarh were the principal sanitary works of importance. But in the Lakhimpoor district, very great progress was made in improving the water-supply for the labourers engaged on tea estates, good wells being made for their use.

1879.—Sanitary work was principally confined to improvements in the water-supply. Schemes were sanctioned for supplying Maokhar near Shillong with good water, and considerable progress was made in carrying them into execution. Again, improvement was effected in the water supply of tea gardens.

1880.—Valuable improvement was effected in the water-supply of Shillong. In Syhlet a well planned system of drainage was completed. At Silchar considerable attention was paid to drainage.

1881.—The Shillong waterworks were further extended; otherwise nothing of importance was executed.

1882.—Little was done, owing to want of funds. The chief improvements were the introduction of a constant water-supply into the civil station of Shillong by iron pipes instead of by an open duct; the progress of the waterworks at Gauhati, and of drainage works at Goalpura.

1883.—The new water-supply for Shillong was completed. The Gauhati waterworks were in progress. The drainage works at Goalpura were completed. All the municipalities spent larger sums than in any previous year on street sweeping, cleansing of drains, and construction of roads and culverts.

1884.—Little done in the way of sanitary improvements, but works in progress continued.

1885.—The Gauhati waterworks were nearly completed. Considerable attention was given to improving the sanitary condition of Dibrugurh. State of tea gardens much improved.

1886.—No work of importance.

1887.—30·43 per cent. of the municipal income was spent on sanitation; but no work of magnitude was undertaken.

1888.—No sanitary work of any great importance; but in the larger towns much was done to improve their sanitary condition, the municipalities spending 55·37 per cent. of income on sanitary works.

Coorg.

1880.—Draining swamp at Mercara.

1881.—Many minor works carried out.

1882.—Draining Hudikeri swamp. Drainage at Mercara, Frazenpett, and Virajendrapett improved.

1883.—Repairs of several wells.

1884.—General repairs to roads and drains. A slaughter-house constructed at Mercara, and a market at Virajendrapett.

1885.—General attention to drains and roads.

1886.—Construction of covered drains at Kodlipett.

1887.—Minor works at several places.

1888.—Several new wells constructed. Improvement of drainage in Mercara, Kodlipett, and in some other towns.

1888-90.—Several new wells constructed and others improved, and much minor work at various places.

British Rajpootana.

Ajmere.

1870 to 1880.—Continued attempts made to secure satisfactory disposal of city refuse at Ajmere. Transformation of a swamp in the neighbourhood into a large flourishing garden.

1883.—A tank known as the Besla filled in. A scheme to supply Ajmere with filtered water commenced.

1885.—A tramway for the conveyance of night soil from the city to a trenching ground commenced.

1886.—Tramway completed and brought into use.

1887.—Tanks for the use of washermen erected, and connected by pipes with the Anasaugor lake.

1888.—Tanneries, &c. removed from the city.

1889.—Masonry cesspools abolished, and iron receptacles substituted in a large number of residences. Waterworks finished.

1890.—City latrines reconstructed. Extension of waterworks sanctioned. A plan for the erection of model quarters for a large number of workpeople passed.

From the districts of Ajmere and Mharnvarrah there is no information.

Burmah.

1876.—A code of sanitary regulations was issued some years previously, but although much useful work had been done, no great scheme had been undertaken. Now waterworks for Rangoon were sanctioned at an estimated cost of 80,000*l*. Extensive drainage improvements were also in progress at Rangoon. Useful work of similar character done in Bassein, Prome, and Akyab.

1877.—Water-supply from the Royal Lake brought into the Poozundong quarter of Rangoon. Good work done in Bassein and Akyab.

1878.—In Rangoon some new masonry drains were constructed. At Prome about 9,900*l*. were expended on reclamation schemes, drains, and roads. Latrines on a new plan were erected. The conservancy of the town of Akyab was greatly improved; also that of Bassein. A series of simple suggestions on village sanitation, drawn up by the sanitary commissioner, were translated into the vernacular, and 10,000 copies distributed.

1879.—There were no very extensive sanitary works undertaken during the year, but several minor works were completed, and others started.

1880.—In Rangoon the drainage was improved, and the Kokine water-supply, to cost 170,000*l*., was advanced. At Merqui bathing-places were constructed away from the wells.

1881.—Rangoon drainage and water-supply works were pushed on. Drainage of Prome was commenced. At Bassein 7,000 feet of masonry drains were constructed, and a great part of the Athegyee swamp was reclaimed. In Toungoo masonry drains were provided throughout the town. In Hengada, Rs. 97,000 were spent on masonry drains.

1882.—The most important works were the continuance of the waterworks at Rangoon and Prome.

1883.—No sanitary works of any importance commenced; but, on minor improvements, there were spent, in 15 towns of the province, 19,996*l.*

1884.—The Prome waterworks practically completed. Drainage at Pegu commenced.

1885.—Nothing important on record.

1886.—In most of the districts some works were undertaken to improve sources of water-supply, and for making and repairing roads and culverts.

1887–88.—Excepting drainage works at Rangoon, and reclamation of low-lying lands about the same town, no sanitary works of magnitude.

1889.—Drainage works at Rangoon still in progress.

Progress of Sanitation and Preventive Medicine in Rajputana.

BY

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A by no means flattering picture has been drawn of the insanitary condition of British India, and it has been shown how formidable the difficulties are which attend any efforts to improve it; but, on turning to the Native States, it will be seen that we are compelled to use yet darker colours in depicting the insanitary horrors which everywhere abound, and that we have to point out that even still greater troubles beset the path of the sanitarian in those important portions of the empire.

Notwithstanding the magnitude of the task, it has been proved that much has been done in British India to mitigate the evils which exist, and I think I am justified in claiming that a somewhat similar success has been achieved in the Native States, and that if we proceed slowly and cautiously, carrying the people with us, we may with confidence hope for still greater results in the future.

Fortunately India is a country of villages. Great towns are comparatively scarce, and to them European methods of cleansing can perhaps be more easily and usefully applied. Village sanitation is in some ways an easier problem, as the limited area to be dealt with is in our favour; but though our rules may be few and simple, still strict supervision will be required in carrying them out, and enormous prejudices will have to be overcome before much real improvement can be effected.

In a typical Rajputana capital the ordinary condition is somewhat as follows:—The poorer classes defile the outskirts of the town, the vacant spaces, old buildings, and nearest highways without the slightest attempt at concealment: the richer inhabitants have private conveniences which are usually so out of repair that the whole house and neighbour-

hood reeks with foul odours which are painfully indicative of contaminated soil and masonry. There are few drains, and, as a rule, these are only cleansed during the monsoon season by the storm water. They are so imperfectly constructed that even then much of the sewage escapes into the earth, and in any case, unless there is a running stream close by, it is deposited on adjacent low ground, where it becomes a hotbed of infection, whilst the wells and tanks in the vicinity are of course contaminated. At the close of the rainy months houses and wells in low-lying situations have been frequently proved to have been the starting points for serious epidemics. Most of the occupiers of Indian houses are so careless that they often permit several feet of the drain pipes which run down the outer sides of their dwellings to remain for years in a broken state, so that the sewage, instead of running off into the cess-pools or gullies, escapes and saturates the walls. These gullies are narrow passages between the houses which ought to be cleansed every day by the sweepers, but rarely are thoroughly purified until their contents have overflowed for weeks into the streets. No man cares what becomes of filth after it is supposed to have left his own house, and even there it is masked by the use of strong perfumes and by superficial washings, perhaps with coloured water. Draught bullocks and horses are stalled round the open court below the family rooms of the most wealthy citizens. Here the sick are also lodged. Milch kine pick up a living in the streets, and their appetites are so depraved that they act as scavengers. At night they live in filthy byres, even below the windows of powerful nobles. Only six months ago a friend of my own, one of the principal nobles of Jeypore, complained to me bitterly that he could not keep open the windows of his private rooms on account of the filthy state of an adjacent cow-shed. He had no legal remedy, nor had the owner of the cattle any against the complainant, who somewhat inconsistently allowed the drainage of his own palace to flow into the street. A few years ago an opportunity was afforded me of showing some of these things to a high official, who, indeed, afterwards became Secretary of State for India. He was horrified to find a sick native gentlemen lying in a room next door to the family stables, and immediately asked whether a change for the better could not be made. I proved to him that nothing short of a revolution in the habits of the people and a re-construction of the city of Jeypore could remedy that evil. The litter from stables and cow-yards, if not eaten by the animals themselves, is used over and over again until it rots. The solid excreta of cattle are turned into fuel, and the liquid escapes into the earth to such a degree that the whole soil becomes highly charged with saline and ammoniacal matter by which the wells are contaminated, and in time their contents rendered undrinkable, so that the city from this cause, and probably from the increasing mortality, has to be abandoned. This explains why almost every great Rajput capital has at least one, but often two or even more, ancient cities close beside it which are now mere ruins. Jeypore, for example, has its Amber, and Jodhpore its Mundore. The British cities of Delhi and Agra are also cases in point. The whole plain round Shahjehanabad or modern Delhi is covered with the ruins of former

capitals. In the city of Jeypore, which was founded as late as in 1728 A.D., only 49 of its 827 wells now contain sweet water. Another reason for the fouling of these wells is the fact that they are usually situated at low points, while the general level of the surrounding soil has been raised by the solid impurities and sweepings which have accumulated to such a degree as to be, in some cases, many feet above the courts and doorways of the houses.

Having thus indicated a very few only of the insanitary defects of large native cities, I will now turn to the country towns and villages, where every man does what is right in his own eyes unchecked by the officials, by the nobles, or by public opinion. The village lanes, it may be, are less defiled by human beings than the streets of towns, but solely because the open country is nearer at hand; anyone, however, who has seen a small town or a large village in the north of Rajputana will not easily forget the want of delicacy of the populace nor cease to wonder at the indifference of the local magnates, who allow the very gateways of their castles to be used as Temples of Cloacina. Many Bombay and Calcutta Marwari* millionaires have their ancestral homes in these desert villages, and the contrast between the wealth displayed within their palatial residences and the condition of the waste ground and lanes without their walls is something astounding. All manure which is not used as fuel is stored up close to the cattle yards and sheep folds, until it can be used in the fields. All that is not ultimately removed for agricultural purposes, or which is not devoured by the village pigs and other animals, remains to form huge kitchen-middens that in time raise the village site high above the plain. The neighbourhood of wells is rarely cleansed, and the storm water often runs directly into them; but it is the village tank, on the margin of which the dead are burned and the dyer carries on his filthy trade, that is the centre of horrors. Here may be seen side by side buffaloes wallowing in the mud, the sacred kine drinking while standing in the water, holy Brahmans washing their clothes and persons and cleansing their mouths, while the patient women fill their earthern waterpots with the precious but filthy fluid which is to serve for cooking and drinking purposes. At the end of a hot and dry season the water in a Rajputana village tank contains little but sewage. Is it, therefore, surprising that diarrhœa carries off many of the villagers, and that cholera, when it appears, spreads like wildfire, until, in despair, the people fly from the spot and encamp in the jungle or on waste lands, where, in spite of heat, wind, and even storm, they are soon healed?

The difficulty attending the sanitation of villages is in many cases much increased by their low situation, which renders them particularly unhealthy after the wet season. On the other hand they are swept through and through by the life-giving winds which blow so violently during many months of the year in North India.

There remain for description innumerable difficulties attendant upon the prejudices and conservative habits of the people, which are too often, unfortunately, on the wrong side. There is, in the first place, in the

* Bankers, who come from Marwar or Jodhpore, and adjacent parts of Rajputana.

ordinary Indian mind an utter disbelief in any but ceremonial cleanliness. For example, a Hindu may not eat from the hands of a man of a different caste from himself, unless (as in the case of the Nai or barber for the Rajput) that caste is permitted by custom to cook for him, but he will partake without question of food that has been well mixed up in a great iron pot by the rough uncleansed feet of a *bhai* or caste fellow, or pass a cigar from mouth to mouth. In the village feasts in many parts of Rajputana, especially amongst the Mhairs and Meenas, filthy proceedings of the kind have often been observed. I am afraid it is little better amongst men of high degree. I believe that the *parshād*, or holy food, of which all castes may partake at certain sacred places, is not prepared in a much more refined fashion. Careful Hindus carry with them on their travels a brass pot or *lotah* to which is attached a long cord, to enable them to draw their own water from the wells. This cord is soon defiled, and so becomes the means of contaminating the water in the wells, and thus may easily lead to the spread of cholera. The brass vessel itself is only cleansed by rubbing it with the foul sand near the man's camping ground, and what a camping ground may be can only be appreciated by those who have seen it after an army of *sepahis* or pilgrims has passed on from it. Epidemics arise most frequently, as we well know, where men congregate in large numbers, but it requires something more than ordinary filth to originate true cholera. Every year fatal cases of so-called summer diarrhœa occur after Indian fairs, and many of these are, I believe, traceable to the habit, which is a very common one in Rajputana, of pilgrims taking with them from their distant homes perhaps as much as a fortnight's supply of cooked and therefore stale food, which they wrap up in a dirty waist cloth or turban, and wear in the heat on their filthy bodies.

The ways of defiling water and food are indeed innumerable. The Brahman washes himself daily as a religious ceremony, but with him, as with too many of his countrymen, or with the Musalman, who in the desert may purify himself with sand, the act is only symbolical, and the washing is, after all, merely a superficial dip in the water, which may be inconceivably filthy, and even that water may be allowed to drip back into the well or on to the well slab—on which the traveller prepares his food. From this it is clear that the protection of wells is a most important matter which is, however, too often neglected. There are religious prejudices against cleanliness that even the most advanced persons, and there are many such in India, are almost powerless to resist. I remember the case of an Indian Bachelor of Medicine, who was ready enough to lecture on the virtues of cleanliness, but who, for several years after its birth, would not allow his own child to be washed, because it had been dedicated to a distant goddess, to whom it must be presented before it had its first bath.

There are innumerable dirty habits, such as expectorating betel on the walls of rooms and staircases, sleeping at night in close, ill-ventilated cells in the clothes worn during the day, or with head and neck enveloped in a filthy cloth, and very many others, all of which are set

forth *ad nauseam* by a Bengali gentleman in a curious little manual which he has published for the benefit of his English-speaking countrymen, and which I need not further describe. Again, there is the family system of living in conjoint households, which brings a great many people together into such intimate relations as must promote insanitation, the accumulation of filth, immorality, and indelicacy, mainly on account of the rigid observance of the laws of purification, which are in brief those of the old Mosaic code as laid down in certain chapters of the book Leviticus. This touches upon the Zenana, which is not so much a question as some suppose of superior delicacy as of what an Indian terms "*izzat*," or family honour and pride. The zenana, instead of being the most pleasant part of the house, is far too often the least cleanly, the darkest, and most miserable portion of it. Fortunately, much is being done by Lady Dufferin's excellent scheme and by other agencies to throw light into these dismal dwellings. In my remarks on Hindus and their houses, I, of course, do not refer to the happy exceptions, which are, alas, as yet far too few.

The sanitarian has to contend with vested interests, particularly of owners of property, of agriculturists, and of sweepers. The expense of rearranging town habitations to meet modern sanitary requirements would be enormous; so also would be the construction of drains in villages. No doubt the State should help in many such projects, but progress must of necessity be very gradual in this direction. The native agriculturalist opposes all improvements which cost money or give him extra trouble. He is rarely, if ever, a capitalist, so cannot afford to store up manure or to trench it. Near the cities the sweeper has hitherto put the manure on the fields at the exact times and on the exact spots on which the cultivator wanted it, and all the latter had to do was to cover it up, and plough it in. No municipality can do as much, and in many parts of India few agriculturalists will undertake to carry the soil themselves, even when it is stored up in convenient depôts until wanted. The convenience of both peasant and sweeper has, therefore, until now, led to the storing up of filth in the towns themselves until the cultivating season. Much of the natural animal manure is lost by the conversion of it into dried cakes for fuel, owing to the scarcity of wood. The women are engaged for many hours every day in preparing it with their own hands, from which results a further evil, viz., that the poor cannot have clean food as long as their wives are compelled to follow this vile practice. A true sanitary reform is, therefore the extension of forests with the provision of cheap fuel. Here, however, the agriculturalist gives further trouble by demanding why his grazing rights are restricted, as they necessarily are by forest reservation. On every hand fresh difficulties spring up.

The sweeper holds hereditary office, and sometimes even goes so far as to pawn or sell his rights. In the city of Jeypore there are more than 1,500 private sweepers. One man may enjoy the privilege of serving a dozen families in as many different quarters of the town, and so may be compelled to spend the greater part of his time in the waste labour of running from house to house. He will not give up his claim upon a

single family, as there are perquisites attached to his office, such as the daily receipt of food, the presentation of clothing on certain occasions, and even of the robes in which the dead are wrapped—a very fertile mode, by the way, of spreading disease, and one which in Jeypore we have tried, but in vain, to mitigate by offering to disinfect all such articles for nothing. The redistribution of these sweepers' walks is one of the greatest troubles our municipalities have to deal with. Some years ago I calculated that the sweepers of Jeypore had never been able to remove more than a fourth of the ordure from the city. I have shown how dogs, cows, Brahmani bulls, swine, peafowl, kites, and vultures do their best with what is left, and if these creatures did not do the work fairly well, life in Indian towns and villages would, perhaps, be impossible. It is said that there are 10,000 pariah dogs in Bikanir, a city of perhaps 50,000 inhabitants, and yet all earn a living, and look sleek, fat and strong. In the absence of a scientific sanitary system nothing could replace them. All this shows how very careful we must be in interfering with what would appear truly to be natural compensations: for example, with the hyperlactation of children who are nursed by their mothers long after they can run about, or with the boiling of milk, which is universal; as it is, perhaps, to these two practices that we owe the fact that there are in India any children who survive infancy. Nearly all the milk comes from foul-feeding cattle. We are not even sure that the universal use of opium for children is wholly injurious; at all events, to enforce mothers to give it up in Rajputana would cause a rebellion.

The result of all these terrible evils is so great that some physicians have gone so far as to declare that we rarely see a case of enteric fever in a native adult, because almost every child who survives has suffered from it in early life. I may observe here that the *baids*, *hakims*, and other practitioners of the indigenous medical systems have done nothing in the way of preventive medicine or of sanitary improvement. In carrying out important sanitary projects we must be very careful how we proceed, as failure on a large scale alarms the people and hinders progress. Within my own experience I have known of the bursting of one large reservoir, the failure of another on account of leakage, the subsidence of the water level and diminution of the water-supply in a whole district, and the breakage of the embankment of a huge artificial lake—all from defective engineering and want of appreciation of the difficulties attending such undertakings. It is in vaccination, perhaps, that our greatest trials have arisen. Ignorance and prejudice have attributed deaths from disease to the operation itself; our objects have been misrepresented; it has been stated that we are in search of the *Imam Mehdi* of the Musalmans, who is said to have milk in his veins; or of the *Kalki Avatara* of Vishnu, who bears marks which doctors would recognize, either of which powerful beings would put an end to British rule; and last, but not least, anti-vaccinationists have appeared even on the edge of the desert in the persons of rich traders returning home from Calcutta, where they have learned the most refined and most modern forms of obstruction. I am inclined, however, to believe with Rao Bahadur Kanti Chander Mookerjee, the able and

enlightened minister of Jeypore, that until we can secure a higher class of subordinate officials than at present exists in Rajputana we shall not be able to carry out really important improvements. The men are ill-paid, though as well paid, perhaps, as their merits demand, as they are full of prejudices, very ignorant, and too often look upon taking bribes as innocent, an opinion which is quite in accord with that of the general public, who regard the offering of bribes as also free from blame.

Having so far indicated the stupendous difficulties with which sanitarians have to deal in Native States, I am in a position to state what has been done in Rajputana, the province which I represent at this Congress; and, although you may have formerly thought that more might have been done, I think, now you have been made acquainted with the overwhelming odds against which we have had to contend, I may fairly ask you to give the Native Chiefs, the British and Native officials, both lay and professional, a good deal of credit for what, under the circumstances, is substantial progress.

The Native States form no mean portion of the empire, as with an area of about 638,000 square miles, or more than two-fifths of the whole, they have 65½ million inhabitants, or nearly eight thirty-fifths of the total population of India. The Province of Rajputana alone covers 129,750 square miles, or nearly 9,000 more than Great Britain and Ireland, and has more than 12 million inhabitants, of whom about a fourth live in the State of Jeypore, for the sanitary and medical arrangements of which I am directly responsible. Medical, engineering, and sanitary progress go hand in hand, and statistics regarding one branch give some indication of what is being done in the others. All civil engineers, and medical officers, with their dispensaries, are centres from which the sanitary light radiates. I shall, therefore, quote some statistics regarding medical progress.

In 1872, the earliest year for which I have the figures, there were 74 hospitals and dispensaries in Rajputana, 12 of which were in Jeypore, at which about 214,000 new patients were treated. There were 76 vaccinators, who performed 69,651 vaccine operations, and the total expenditure was Rs. 48,875. There were 300 major and 9,960 minor operations. These institutions were under the general administrative supervision of Sir W. Moore, at that time Superintendent-General of Dispensaries in Rajputana. In 1879, when Brigade-Surgeon G. S. Sutherland was Superintendent-General, the figures were respectively—76 institutions; 306,592 new patients; 393 major and 15,957 minor operations; 75 vaccinators and 74,842 persons vaccinated; the total cost being Rs. 81,162. In 1889, under Brigade-Surgeon Spencer and Surgeon-Major Newman, there were 154 institutions and 636,538 new patients, or twice as many of each as in 1879; 1,163 major and 42,118 minor operations, or nearly three times as many; 191 vaccinators and 219,775 persons vaccinated, or in both cases three times the number; while the total expenditure reached Rs. 195,128.

These figures clearly show the greatly increased popularity of the institutions, and the extension of the efforts which are being put forward

to prevent and treat disease, and thus indirectly to clear the way for the sanitarian. With the exception of Ulwar, where there is a dispensary cess, the entire cost was met by the Native Princes. In Jeypore the number of institutions has risen in 10 years from 16 to 26, and the attendance has increased from 61,606 to 163,940. We have now a dispensary within 25 miles of almost every person in the State, which serves, in addition to its proper function, as an educational centre in sanitary matters as well as a meteorological observatory. Latterly I have endeavoured to gain the sympathies of the agricultural community by keeping in dispensaries vernacular manuals for teaching the modes of treating cattle diseases, which the hospital assistants have explained and used on occasion with most gratifying results.

As regards general sanitary improvements in Rajputana in the large towns, special attention should be drawn to the water-supply. The city of Jeypore has been provided, under the able supervision of Colonel Jacob, C.I.E., the State Engineer, with an excellent constant service obtained from an adjacent stream. At Jodhpore new tanks have been made, from which water is brought into the city by aqueducts. At Ajmere an elaborate scheme has also been carried out; but much remains to be done in the other large capitals. At Jeypore, Ajmere, and Oodeypore there are new and beautiful public gardens which are much appreciated by the people. As regards conservancy, the most energetic attempts to deal with the question have been made in Ajmere, Ulwar, and Jeypore. In Jeypore a 16-inch portable railway has been laid down inside the south wall of the city for a total length of 12,500 feet. Since 1887, by means of it 152,695 waggons of foul earth and 50,802 waggons of ordure have been removed, and in the year 1890, in addition, 893 dead animals. All this is over and above the work ordinarily done by the sweepers. In 1887 and in 1888 1,006 gullies or latrine lanes were cleaned out. So much foul earth was removed from the upper part of the city that it presented quite a new aspect. This work involved the putting down and taking up of 10 miles of line, and yet only one district of the city had so far been touched. Many latrines have been provided, and the first great step in all municipal improvement has been taken, viz., that of clearly numbering the houses and naming the streets. Registration of births and deaths is carefully done in Jeypore, Ulwar, and a few other capitals, but is at present unreliable for the rural districts and for the country generally. The main streets in Jeypore, Ajmere, and in some other cities are regularly swept, and, in some instances, watered. In Ulwar the sanitation was greatly improved under Dr. Pank, owing, in a great measure, to the personal support and interest of the Maharaja. In Jodhpore, Kotah, and other places, many latrines have been built.

Great sanitary improvements have been recently made in Jodhpore under Dr. Adams, with the cordial support of the Durbar and of Colonel Powlett, C.S.I., the Resident; the present Prime Minister, Sir Partab Singh, K.C.S.I., takes great interest in the subject. Bikanir, too, has made great strides under Major Talbot, C.I.E., and Dr. Pank, aided by the State Council.

I have included Ajmere, although it is a British town, because it is in the centre of Rajputana and is under the same medical administration. Its sanitary progress, which has been great, naturally attracts the special attention of the Native Princes. It has a municipality, and has been particularly fortunate in having had, in Dr. Newman, the same health officer for a long term of years. Some of the smaller capitals are still very backward.

Advance has been made in the condition of the jails of Native States. Twenty, nay even ten years ago, the prisons were very much overcrowded, the food was bad, the prisoners were fastened together at night with a long chain, and men and women frequently lived together in the same rooms both by night and during the day. With the exception of overcrowding, which is still far too common, these abuses have been rectified in all important jails, and the district prisons and lock-ups have been greatly improved. Many new jails have been erected. In Jeypore, for example, a second huge prison has just been constructed on the most modern principles. Very shortly there will be in each Jeypore rural centre, not only a good dispensary as there already is, but an excellent jail and superior public offices. Extensive irrigation works, particularly in the Jeypore State, have also materially aided the sanitation by improving the food supply of the people. In all the States, perhaps, the greatest progress has been made in vaccination, for although but a small percentage of the population is as yet protected, sufficient has been done to very markedly reduce the mortality and disfigurement from small-pox. It is impossible to give the figures for any State, but epidemics in the capitals are much less frequent and widespread than formerly. I remember when, in one year alone, more than 1,300 children died from small-pox in the city of Jeypore. Well may children be termed *Mata ka Khāj*, or the food of the Goddess of Small-pox. No such mortality has been approached within the past 15 years. Doctors T. ffrench, Mullen, and Adams have done special service in this cause.

In the past, complaints of private individuals regarding nuisances were rarely attended to. Now all municipalities and health authorities make efforts to abate them, and, in consequence of the general improvement of government in many of the Rajput Native States, there is an increasing readiness to make such applications, and to believe that the laws will be applied to all classes alike. Very much, however, has still to be done under this head. Some effort is being made, especially in Jeypore, to raise up a more educated class of officials, and the elements of sanitation are being taught in the schools and colleges. The young nobles at the Rajput College at Ajmere are not forgotten in this respect. In Jeypore I have circulated and posted up in many public places brief rules for the management of accidents and sanitary regulations, in the hope that good may be done. Similar efforts have been made in other States, and special means are adopted to prevent the spread of epidemics by distributing medicines, and by attending to the sanitation of fairs and other large gatherings. Surgeon-General Cuningham's Sanitary Primer has been used in many of our educational institutions, and a

more advanced treatise has been issued by the Government of India for the use of students in the higher classes, but my own experience leads me to believe that, for a long time to come, Dr. Cuningham's valuable work will prove almost too difficult for the blank state of the ordinary Hindu mind on this subject. As example is better than precept, I may point to that set by many Native Princes and enlightened citizens. The Palace of Jeypore is a perfect paradise to what it was when I knew it first, some 17 years ago. H.H. the Maharaja, the present owner, who is extremely liberal in all that concerns the health of his people, once hit the right nail on the head, when he told me that he could only secure cleanliness by frequently moving his quarters from one set of rooms to another. Constant inspection by good officials is the secret of success. Insanitary trades still flourish within town limits, and can only be dealt with very gradually. The horrors attending native childbirth are well known. We are starting a school for teaching the *dhais*, or native midwives, the elements of good management in such cases. I may note that educated native gentlemen, who are fathers, are now frequently found studying the useful manuals of Dr. Murdoch Smith of Madras on this and kindred subjects.

I wish I could speak favourably of the progress of sanitation in our villages. We publish only the most simple rules, as, for example, that all manure should be placed on the leeward side of the village, that the wells and the ground for a few yards round them should be kept clean, that well-parapets should be raised, that one water-source should be reserved for drinking purposes, and that the people should be compelled to go a certain distance outside the village for natural purposes. So far, little or nothing has been done, and for the reasons I have clearly indicated; yet I am sure it will be dangerous to use pressure. We must proceed slowly and with great tact, and always on the same lines, so that the evils attending change of officials may be minimized as much as possible. For this purpose it is wise to print full reports, so that the work done one year by one man may not be undone the next by his successor.

Sir W. Moore, whom I regard as the father of modern sanitary progress in Rajputana, has described the enormous and complicated efforts which have been made to make a nation of 220,000,000 British subjects clean, and has shewn that most authorities have regarded the problem they have to deal with as a very complicated one. There is an instrument in use in Jeypore for recording all the ordinary meteorological phenomena by means of electricity. By most persons it would be looked upon as a most elaborate and intricate machine, but the inventor assures us that it is only complex, that is to say, it is the assemblage of a number of very simple instruments on the same plane. It appears to me that this is the kind of problem we have to deal with in the sanitation of the Native States, if not of all India. It varies in every part of the Peninsula, but in every case it will have to be, and can only be, dealt with by the most simple methods. It will be neither wise nor safe to press upon the people of India elaborate and difficult systems which

require, to ensure success, heavy outlay, great care, and, in case of failure, punitive measures and undue interference with the liberty of the subject. The peasant must not be worried by those who desire to retain his affection, and with it permanency of rule in India. In the attempt to improve we must work on those lines which have been proved by survival and experience to be the most fit. These will be found, as I have already indicated, in most Native States to be, in addition to the spread of knowledge by sanitary teaching in private schools and such like measures, the employment of hereditary sweepers to remove and place upon the soil for tillage the excreta of the towns, and in villages the more strict observances of the old Jewish law which ordained that all that was insanitary should be done beyond the camp. The key to rural sanitation is the breaking up of villages, as far as possible, into isolated households and farmsteads, but cities must be specially and scientifically dealt with. Above all, we must beware how we apply Occidental methods, with their constant progress and extreme changeableness, to the East, where the greatest tribute to a good ruler's name always was that in his time the land had rest. *Festina lente* should be the motto of all sanitarians in India.

I have only now to add that it has been impossible for me to do justice to all who have worked in Rajputana in the cause of sanitation. The Native Princes and their advisers, before whom the subject has been kept in the greatest prominence by the Foreign Department of the Indian Government, have done far more than any one could have dreamed of 20 years ago, and officials—whether political, medical, European or Native—have shown an amount of zeal and energy which has been truly remarkable.

DISCUSSION.

Brigade-Surgeon R. Pringle, M.D., Indian Medical Department, drew special attention to the population of the country, the sanitary progress of which had been so fully and ably described by Sir William Moore; and stated that if in that land of female seclusion and female infanticide 285,000,000 persons were enumerated, we might be sure there were that number at least, as vast numbers of girls must have been left out of this enumeration. In passing, Dr. Pringle observed that, as the result of his twenty years' continuous experience of the Garden of India *i.e.*, the upper portion of the Mesopotamia of the Ganges and the Jumna, the death-rate on an average was 40 in 1,000, and the birth-rate 60 in 1,000. Dr. Pringle based his remarks on the lines suggested by Miss Florence Nightingale, that "friend of the sufferer," and drew attention chiefly to the sanitary wants of the village population, which, as Sir William Moore had pointed out, constituted 95 per cent., while that of the towns and cities was only 5 per cent. of the peoples of India. The point of sanitation for the village community was the well; and in alluding to this, Dr. Pringle said, that in the rains they were little better than cess-pools; but added that, in his paper on "The Water Supply of India," he would allude to this in detail. Few would wonder at the awful mortality from fever and bowel com-

plaints who saw the water these people consumed, for like their cows, they cared little what kind of water they drank. In the Himalayas, Dr. Pringle said that leprosy must increase, as the poor leprous women, who were invariably pushed over precipices, were now protected, and it is much to be feared that in their outcast life they will be a source of real danger to the troops, not only on the hills but also in the plains. The extension of the canal irrigation, or rather inundation, by the Deoban high level canal was, in the face of the awful mortality of the previous years, an absolutely indefensible act, and was a grave and calamitous blot on sanitation. The laziness caused by this inundation led many of the cultivators in these districts to indulge in opium, certainly not for its prophylactic or febrifuge, but for its pleasurable effects; and this naturally brought him to the question of opium as a prophylactic. During his thirty years' Indian service from Juggernauth on the Bay of Bengal to Gungootree in the Himalayas, during which period he had seen as much natural and artificial malarial fever as falls to the lot of most medical officers, Dr. Pringle had never heard of opium being used as a febrifuge or as a prophylactic for this disease; and, though the fever of Rajpootana differs from the artificial malarial fever of the North-west Provinces and the natural malarial fever of the jungly hill tracts of Lower Bengal and Central India, yet it is difficult to suppose that this difference is such that what is taken as a luxury in the North-west Provinces, Oudh, and Bengal is a necessity in Rajpootana. Yet, if this necessity can be established, then it is hard to understand how the Commissioner of the Central Provinces (those adjoining Rajpootana) can congratulate his administration on being the one that placed the highest duty on opium. Were Sir William Moore's theory correct, and opium all he claimed for it, it would be as just to the fever-stricken people to tax quinine and cinchona, as by a high duty to put opium, this supposed necessity of health under certain conditions, out of the reach of these poor people. As instances of municipal sanitation, Dr. Pringle alluded to Muttra and Hurdwar, both sacred cities. The former, thanks to the good influence of the late Bradford Harding, B.C.S., was a model of sanitary cleanliness, free from epidemics of any kind; the latter the most insanitary town in the North-west Provinces, a place ever ready to start a cholera epidemic from filth, impure water, and over-crowding. Alluding to the sanitary progress as seen in the improved value of the life of the British soldier, Dr. Pringle stated that, while giving every credit to sanitary improvement, even after excepting the cholera-centre barracks at Meerut, and the homes of fever and dysentery in the over-ventilated barracks at that station, moral and not physical sanitation was the great cause of this improvement; and for the harbours of refuge suggested by him years ago, and since carried out by Sir Frederick Roberts, the present Commander-in-Chief, where temperance was inculcated and total abstinence practised, must be claimed much of the credit which physical sanitarians so persistently urge is due to themselves.

Mr. E. C. K. Ollivant, C.I.E., said:—My only justification for responding to the call that has somewhat unexpectedly been made upon me lies in the fact that the city of Bombay has asked me to come here as its representative, and that, as the officer charged for nine years with the chief executive administration in that city—a city which in recent sanitary progress is fairly entitled to its proud motto, "Urbs prima in Indis,"—I have been connected in a very practical way with many of the important subjects touched upon by previous speakers. If the delibera-

tions of this section of the Congress tend to increase the sympathy felt in this country for India, and to bring enlightened opinion to bear upon many of the sanitary problems that have to be solved there, its work will not be in vain. I was glad to hear one of the previous speakers say that our watchword must be *Festina lente;* and it must be remembered at the outset that it is as unreasonable to generalize about India in sanitary matters as it is, so Sir John Strachey's book on India reminds us, in regard to racial and geographical characteristics. For on the one hand we have rural districts for which the only suitable measures must be of the most elementary Mosaic description, and on the other we have large cities, such especially as the one which I have the honour to represent, where we need to apply all that science and the most modern experiences of European towns of corresponding importance can give us. In the one case "fads," over departmentalism, and premature legislation may be the worst foes to real progress; in the other the most approved schemes of European science may fail if they are not introduced with the adaptations required by local habits and conditions. The chief factors for improvement must be the spread of education, personal influence, and the gradual force of example, the example, namely, of what is being accomplished in the leading cities. Whether for towns or villages, the improvement of the water-supply is no doubt one of the first objects of attention, and this in the present day is a comparatively popular reform. A marked diminution in cholera is the result; but it is a fact too often forgotten that the introduction of a large body of water must be attended by efficient drainage provision, unless there is to be an inevitable aggravation of the feverishness of the locality. I should like here to say one word on the subject of these vital statistics, to the accuracy of which all health reports owe their value. My experience leads me to think that at present they are very unreliable. I well remember that it was my duty some years ago to examine the registers in a rural district, and in village after village the recorded deaths so largely exceeded the births that the only inference could be that the whole district must soon be depopulated. No such calamity was taking place; but the explanation lay in the fact that it was then, and still is, much more difficult to obtain a return of births than of deaths. In the city of Bombay the experience has been to the same effect. The registration of deaths there, though not of death-causes, is, I believe, fairly accurate; but no means have yet been devised for obtaining a correct registration of births. For improvement in this respect I do not advocate punitive measures, except very sparingly, but I would rather endeavour to attach some advantage to the registration. For instance, it may be worth while for the authorities to consider, now that the age of children in regard to factory employment receives so much attention and is often so difficult to determine, whether it might not be notified that after a certain number of years the production of a birth certificate would be accepted as the only conclusive evidence of age; and a similar provision might extend to candidature for employment in the public service. If large classes of the population could be got to interest themselves in the matter, the practice of regular registration would be established.

Now I turn briefly to the progress made in the city of Bombay in large sanitary measures, and, as a general indication of this progress, I may mention that recent legislation has given to the city, in a compact codified form, comprehensive statutory provisions regarding every branch of municipal government, which will bear favourable comparison with

any that can be found in the foremost European cities. Constitution of the governing body; electoral qualifications and arrangements; the assessment of property to the rates; the collection of revenue; the mode of accounting for it and of applying it; borrowing powers and the repayment of loans; sanitary provisions regarding infectious diseases, dangerous trades, markets, and slaughter-houses, and the prevention of nuisances; special chapters on streets and buildings, water supply, and sewerage; the measure of control to be exercised by superior authority; all these subjects find their due place in the code, and I am glad to see that the statutory provisions are now being supplemented by much-needed building byelaws on the lines *mutatis mutandis* of the model byelaws under the English Public Health Act. Under every one of the heads which I have mentioned great progress has been made, but time does not permit me to go into details. Bombay may well be proud of its public buildings and of its docks. Its main thoroughfares present at least as good an appearance in reference to road construction and maintenance as those of many European towns with which I am acquainted; its principal market receives the approbation of all visitors; the sewerage works and waterworks now under construction or approaching completion follow the best European models, and the visit of H.R.H. the Duke of Clarence, last year, was signalized by a munificent donation from a well-known Parsee gentleman (Sir D. M. Petit) to supplement the existing hospitals by the establishment of a much needed leper asylum. This last scheme of improvement has since been largely developed by the energy of the present Municipal Commissioner, Mr. Acworth. Much has been accomplished, but much remains to be done, especially in regard to the completion of the sewerage works, the better disposal of refuse, and the better lighting of the city. I wish more particularly to refer to sewerage works, the disposal of refuse, and waterworks, as showing not only how real are the efforts that are being made, but how special local circumstances must be taken into consideration even in applying the best European experience; and lastly, how inseparable is the question of finance from the successful accomplishment of large sanitary works. Both the sewerage works and the water-works now approaching completion owe their conception to Major Tulloch, R.E., the present chief engineer of the London Local Government Board, to whom Madras, as well as Bombay, is, I believe, under many obligations. As an illustration of local circumstances to be taken into consideration, I may remind my audience that there are no such things as kitchen grates, no back yards, and that the refuse consists entirely of light vegetable matter; also that earth is largely used for the scouring of utensils. The consequence is that the litter is thrown into the streets, that the earth scourings are often stuffed into the nearest drain pipe (thus necessitating special house fittings), and that there is no valuable incineratory residuum, as there is in the refuse carried to the "Destructors" in many English towns. Add to this the fact that coal is five times the price in Bombay that it is in Manchester, and that during the rainy months the litter is absolutely sodden. Then again, within 10 miles of Bombay there is a practically unlimited area of land now barely covered with salt water, and valueless, but which, when reclaimed with street sweepings, is capable of yielding 15*l.* an acre. This is a sample of the special circumstances to be taken into consideration in solving some of the practical sanitary problems in Bombay. Again, with regard to sewerage works; it has been clearly demonstrated that,

whatever may be the comparative advantages of what are known as the "combined" and "separate" systems for English towns, the "separate" system is the one, both on the score of expense and of climatic conditions, which is suitable to Bombay. A very careful and unprejudiced comparison of the two systems may be found in a report by Mr. Rudolph Herring to the United States National Board of Health in 1884. The Bombay sewerage works, now in course of construction, are being carried out by Mr. Walton, who has an almost unrivalled experience in Indian city sewerage, and they have recently been examined and reported on by an eminent English sanitary engineer, Mr. Baldwin Latham. The chief difficulty in regard to them is, now, the financial one. The waterworks just approaching completion are known as the Tansa works, and were carried out entirely under the able supervision of Mr. W. Clerke. This is a work of which the city may justly be proud. It will give the people immediately 17 million gallons daily, or, adding this to the existing sources of supply, about 30 gallons per head per diem of lake water. The Tansa lake, artificially impounded by one of the largest, if not the largest masonry dam in the world, is situated about 40 miles from Bombay, and the water is brought in partly by a masonry conduit and partly by a 48-inch iron pipe. So that by laying an additional 48-inch pipe, without increasing the capacity of the conduit, and without raising the dam (although it is so constructed as to be capable of raising hereafter), the supply can be increased from 17 to 34 million gallons per diem. The works cost approximately a million and a quarter sterling; and from what I have said it will be seen that part of the expenditure has been incurred solely for the benefit of futurity. This is a circumstance which may well be considered to entitle the city to the fullest measure of reasonable liberality in its loan transactions. Moreover, it must be remembered, in regard to all the large sanitary works which the city has now been called upon to undertake, that the present generation has inherited nothing from its predecessors. It is especially with regard to this question of finance that I ask the indulgent attention of this audience. I well remember how, when, about seven years ago, I invited tenders for 40 lakhs of rupees, to bear interest at five per cent., as a first instalment towards carrying out some of the large works to which I have referred, I was dismayed when less than 10 lakhs were tendered, and this, too, at rates averaging about 92. Fortunately, a friend came to my rescue with an offer of 20 lakhs, which he has now no cause to regret. This inspired confidence; and though something like 10 times 10 lakhs have been borrowed since that date, Bombay five per cent. municipal securities now stand at 105. They may well do so, for the financial position of the city is sound, and its debentures are every bit as safe an investment as Government paper. Moreover, no loan can be raised without the approval of Government, and a private company would have been only too glad to undertake the Tansa works merely for the profit of the undertaking. But owing to what, I humbly think, are unwise and unnecessary restrictions, there is some fear whether, without undue burdens on present taxpayers, funds can be provided to complete indispensable works. Bombay may well wonder why, with its present municipal self-government, its assured position, and the enterprise it has evinced, it should not aspire to the same financial treatment that is enjoyed by other cities of the Empire. Its own Act provides that loans may run for 60 years; but notwithstanding the exceptional character of the Tansa works, which might well justify special legislation, it has been rigorously limited

to a period of 40 years. I understand that an English city, for a project endorsed by the Local Government Board, may either go into the best market for its loan, or obtain the required funds from the Public Works Loan Commissioners at 3½ per cent.; but the Indian Government were unable to accede to the application of the Bombay Corporation either for a loan or even for a guarantee; and, being restricted to the local Indian market, the city does not enjoy in England the borrowing facilities of which even foreign towns may avail themselves. It would ill become me to speak disrespectfully of the decision of Government, and being unaware of the reasons which led to that decision, I am unable to criticize them; but this I know, that the prayer of the Corporation was endorsed by such an influential body as the Bombay Chamber of Commerce, and in view of the very grave sanitary interests involved, I shall be very glad if the sympathetic attention of this Congress should conduce to some of the fetters being removed, and to the performances, assured position, and wants of the Bombay Corporation becoming more accurately known.

A letter was read from **Mr. P. M. Tait,** Delegate from the East India Association, calling attention to an article in the "Calcutta Quarterly Review," of July 1891, dealing with the rate of mortality in India according to the census of 1881. Mr Tait added:—"There can be little doubt "that the death-rate in India could, by sanitary reforms, be made to "approximate to what it is in England."

Brigade-Surgeon Harvey, I.M.D., said that, as a delegate from the Government of India, he wished to assure the meeting that that Government was thoroughly alive to the importance of sanitary improvement, as Sir William Moore had shown. It had already done a great deal, and when it was reproached for not having done more, it could only plead the enormous extent of the work remaining to be done, and the impossibility of doing it all at once. It was sore let and hindered by two great obstacles,—the ignorance, apathy, and prejudice of the native populations, and the lack of money. The natives, though differing enormously among themselves in race, in religion, manners, customs, and other ways, were unanimous on two points, their dislike of innovation and of taxation. They had for the most part no idea of the benefits of sanitation, or of the dangers which resulted from its neglect. What was good enough for their fathers was good enough for them, and it was exceedingly difficult to bring home to them that they derived any personal gain from the expenditure on sanitary improvements. The cry of religion in danger was invariably raised when any innovation was attempted. It was so the other day, when the age of marriage for girls was raised from 10 to 12 years. It was so over schemes for better water-supply, over vaccination, over public latrines and other matters. It would take a long time to educate them to appreciate modern ideas on sanitation. A government, and especially an alien government, could not offend the root-ideas of its subjects; but the Government of India were doing their best. The second great obstacle in the way of the Government was the question of cost. The needs of India were enormous. An income much larger than that available could be profitably spent in developing the resources of the country. A crowd of greedy applicants assailed the Government on all sides for grants. Roads, railways, canals, and irrigation schemes, forests, telegraphs, barracks, court-houses, and other public works, to say nothing of periodical famines, and the constant

demand of the military authorities for troops, munitions, and frontier defences, would take much more than Government can spare; and all are urgently needed, so that it was hardly to be wondered at that schemes,—the practical advantages of which were not immediately apparent, and the results of which might not be evident till the next census,—which, moreover, are seen to be met with strenuous opposition and protests from the very people intended to be benefited,—should be crowded out in the scramble for Government allotments. Those who know the country and people best, best know that the motto of the Onslow's must be their motto if they wanted to get on at all. Only the other day serious riots were caused at Benares because the pipes of the new water-supply interfered with the foundations of a temple, and such possibilities have always to be faced. Government, as he began by saying, is doing its best, and has done a great deal, but it must carry the people with it before any adequate results can be attained. An illustration often brought facts home better than a mere statement, and he would give the following story to show the enormous cost of improvements in such a population as that of India. Some years ago it was discovered that cobra-poison could be neutralised by the immediate injection of a solution of permanganate of potash. An irresponsible newspaper promptly suggested that now at last Government would do something to save life from snake-bite. He made a little calculation, that to carry out this suggestion the Government of India would have to include in its next budget an estimate of one hundred and twenty millions sterling in order to supply the population with hypodermic syringes and phials of permanganate of potash.

Mr. Russel Aitken, M.I.C.E., quite concurred with the former speaker, for when he was engineer for the city of Bombay in 1866, seven years after the Vehar water was laid on, many of the natives would not use "pipe water," and would only drink water out of their wells or tanks; but this prejudice is now extinct. He quite agreed with other speakers that the first necessity in India is a pure water-supply; other things may be considered as of but minor importance. In his Report on the extension of the water-supply of Bombay (1868), he wrote as follows:—"To those who are acquainted with what Bombay was before the "construction of the Vehar works, it may appear to be a waste of time "to dilate on the great sanitary improvement which has followed the "gradual introduction of the Vehar water; indeed, so marked has that "improvement been, that the densely crowded portions of the native "town where only Vehar water can be procured are freer from disease "(more especially cholera) than are many of the open places where wells "are numerous. Fever, formerly the scourge of the place, has been "kept in check, and the mortality from this cause greatly diminished. "Cholera, which at one time constantly hung about the town, has during "the last three or four years become almost unknown, and the cases of "disease which now occur have lost much of their former virulence; "guinea-worm, which was almost universal, is gradually disappearing; "elephantiasis is becoming more rare. In short, the health of the "community has so much benefited by the introduction of Vehar water "that the loss of it would be the greatest sanitary calamity that could "befall the city." One of the delegates from Bombay had given a description of the large sums lately spent on drainage and waterworks in that city; but when Mr. Aitken was last year in Bombay, he considered it his duty to write to the papers to point out that the drainage was a

failure. After this letter appeared, the Corporation was served with a number of notices of nuisance. Whilst practically admitting the nuisance, it was arranged that an engineer should be got out from England to remedy it. This engineer recommended that the outlet for the sewage should be, as proposed by Mr. Aitken, at the extreme south of the island, and not where it now is. Again, the waterworks were referred to as having an enormous masonry dam. That was no advantage; what is required is to impound water with the least expense, and this Mr. Aitken proposed to do at another site for a reservoir, for one-third the cost for the same amount of water. His object in mentioning these failures was to point out the necessity for a public inquiry being made before such works were undertaken,—an inquiry such as takes place in England before municipalities are allowed to raise money for sanitary and other purposes, instead of the endless speeches and minute writing such as now goes on before Government sanctions a work. This gradually swelling bad debt is a serious danger to India, and the Government should think twice before they guarantee such local liabilities.

Mr. T. H. Thornton, C.S.I. (Delegate for the Punjab, and formerly Secretary to the Government of that province), observed that the interest shown by the chiefs and people of India in the present Congress was of itself a gratifying sign of progress. In two cases he could call to mind feudatory states which had, in matters affecting public health, set an example to the rest of India. The first city in India, other than the Presidency towns of Calcutta and Bombay, into which a scientific system of pure water-supply was introduced was, he believed, the city of Jeypore, capital of the feudatory state of that name, whose ruler, a Hindu of very high caste, did much by his enlightened action on this occasion to remove the prejudices of his fellow religionists throughout the Empire against schemes of water-supply. Again, the first place in India—indeed, if he mistook not, the only place—in which the cellular system of imprisonment had been introduced, was the feudatory state of Bhawalpore. The cellular system of imprisonment, apart from its desireability on other grounds, was the true, if not the only means, of effectively preventing those outbursts of infectious disease which caused such terrible mortality in Indian gaols. The system had been declared unsuitable for India on the ground of the excessive heat of the climate. The experiment in Bhawalpore showed this ground to be untenable, for the prisoners in Bhawalpore gaol, one of the hottest in India, were particularly healthy. He had only time to touch briefly upon two of the subjects for consideration. He would first advert to the kind message, conveyed through the Chairman, from Miss Nightingale, urging that attention should be given to the sanitation of rural villages as well as to that of towns. While heartily sympathising with the benevolent object of the message, and in no way undervaluing the importance of village sanitation, Mr. Thornton thought that, as a matter of prudence, it would be better for the present to concentrate sanitary efforts upon towns, and not to fritter away resources and to irritate the peasantry by forcing upom them elaborate systems of conservancy which they at present failed to appreciate, and which could only be carried out by an army of officials. Towns, on the other hand, were the *foci* and radiating centres of disease. If they were set in order and made healthy, much would be done; towns moreover were centres of intelligence, and their example would gradually influence the neighbouring peasantry and render them amenable to successful sanitary treatment later on. The other point he would advert

to, was one which demanded very serious attention. Much, no doubt, had been done by the British Government to mitigate the ravages of small-pox and dysentery, and to diminish the prevalence of sores and some other forms of disease once rampant in India; and there was much force in the remark of one of the preceding speakers (Dr. Harvey) that it was impossible for the Government of India, with its limited resources, to take up instantly all the panaceas advocated by philanthropic faddists. But there was one matter in regard to which the Government of India were under a special obligation to do more than it had done. For purposes of revenue the Government had constructed extensive irrigation canals; they were magnificent engineering works, and of the greatest benefit to the people, but owing to the imperfect drainage of the lands irrigated, and to the absence of proper arrangements to prevent excessive watering, many of those canals—especially in Northern India—had rendered extensive tracts of country malarious. They had heard from Sir William Moore that, in respect of malarial fevers, India had not only not progressed, but had gone back, and that the most unhealthy parts of India were those watered by Government canals. Some of the results were truly appalling, but he had no time to discuss them; they were, however, well known to the Government of India. Something, no doubt, has been done to remedy the evil, but a good deal more was required. What was wanted, in respect to the canals of Northern India at any rate, was a proper system of surface and subsoil drainage of the lands irrigated. No doubt the works necessary for effecting this object would be costly and require time, but meanwhile certain remedial measures should be undertaken without delay. If they could not drain away excess water, they could at any rate do more than had been done to prevent excessive flooding. He had made some suggestions on the subject in a paper published in the journal of the Society of Arts, and would conclude what he had to say by reading them:—

"At present, the water from the Government canals is supplied usually by 'flow,' that is, it is allowed to run directly from the distributory on to the field by force of gravitation. It is not charged for by strict measurement, but each crop has so many 'waterings' given by a very subordinate official, and the only check on unnecessary flooding, is occasional inspection by a few superior officers. This is a system very comfortable for the irrigators, and for the subordinate official, but it is the chief cause of all the over-irrigation from which the country is suffering so seriously.

"What is the remedy for this state of things? One remedy, suggested years ago, is to supply and charge for all water for irrigation, by strict measurement, just as gas is supplied to households. This would be an excellent arrangement, but, unfortunately, it has hitherto been found impracticable. Many ingenious water-meters have been invented and tried, but, without exception, they have failed. Would it not be well for the Government, in a matter of such supreme importance, to offer a handsome reward for the invention of a water-meter which will fulfil the requisite conditions of efficiency, simplicity, and cheapness? In Lombardy, water is sold for irrigation by measurement. Why should not that which is possible in Lombardy be possible in India?

"Another remedy, suggested by Lieut.-General Crofton, R.E. (one of the most distinguished authorities on canal construction and management), when Superintendent-General of Irrigation in the Punjab, was to limit the quantity of water supplied to low-lying villages, leaving the

village commune to distribute the reduced amount. Such a plan, it was urged, besides reducing the possibility of over-saturation, would, by making water precious, create a wholesome public feeling in favour of economy. But the idea was rejected at head-quarters as interfering with the revenue. Another measure, suggested and strongly urged by the the late Sir Donald MacLeod, was that local governments should be empowered, on the advice of their Sanitary Commissioners, and after due notice, to prohibit "flow" or "high level" irrigation in malarious tracts, and require the canal authority to deliver water for irrigation a little below the surface of the field. The cost and labour involved in raising the water even a single foot would, it was believed, suffice to prevent flooding. This suggestion was opposed by the canal officers, as involving too great a sacrifice of revenue, the rates for 'lift' irrigation, as it is termed, being only half the rates for 'flow,' and by landowners and cultivators for obvious reasons. As usual, vested interests prevailed, and the general community suffered.

"If none of these suggestions are practicable, let others be proposed; but some palliative remedies ought, surely, to be applied quickly, even at some sacrifice of funds, for, if I am not greatly misinformed, matters must be getting worse and worse, the malaria more widespread, the health of the people more undermined, and the land more waterlogged and defertilised. . . . . It is true that the measures which have been suggested, or others having a like object, may enhance the cost, and reduce perhaps for a time the profits of canals, and probably raise a not unnatural outcry from canal projectors, canal officials, and cultivators; but if carried out they will, if I mistake not, be ultimately beneficial to all parties, economise water, improve produce, and save a multitude of lives."

Brigade-Surgeon McGann (Delegate from the Government of Mysore) said:—I must ask the indulgence of those present in addressing the following remarks to them on some subjects connected with village sanitation in India. The whole range of subjects gone over by Sir William Moore is so large that it would be impossible to refer to them all, even in the most cursory manner, in the limited time at my disposal, and I shall confine myself to a few of the principal requirements as bearing on the health of the rural population generally. I shall, for the same reason, omit all reference to the towns, large and small, in which there are municipalities, for in these there are special agencies—concentrated so to speak—provided for looking after their sanitary wants, and imperfect though the condition of very many of them is in this respect, they contrast favourably with the state of the villages and localities far removed from the observation of officials, medical or other; and it is to the population inhabiting the latter, which constitute 95 or 96 per cent. of the whole, that I propose to confine my remarks.

I would premise by stating that the area of Mysore, one of the principal native states in India, which I have the honour to represent at this Congress, is over 25,000 square miles; that its population is over four millions according to the census of 1881, with an average density of 167 per square mile. The birth-rate for 1888, which is the latest year for which I have data with me, was 23·94 per mille, and the death-rate 17·3. The total deaths for that year were 70,791, of which 1,015 were from cholera, 5,654 from small-pox, 37,609 from fevers, 5,861 from bowel complaints, 1,060 from injuries, and 19,592 from all other causes.

Now, out of every 1,000 deaths from all causes, there were 14·34 from cholera, 79·87 from small-pox, 531·27 from fevers, and 82·79 from bowel complaints. I quote these figures to show the enormous mortality which occurs from fevers, and the large mortality which also occurs from bowel complaints, as compared with cholera, which by some sanitarians is given more consideration than these other, yet more lethal, diseases. For the purposes of this paper, I propose to place all three affections in one group, for the reason that I consider the same preventive measures, viz., improved sanitation, both domestic and general, apply with equal force, looking at the question in a general sense, to all of them.

In passing, I would remark that the prevention of cholera by restrictive measures—such as quarantine, police cordons, and the like—is impracticable, and has hitherto proved ineffective; and that the measures referred to are the only reliable ones. They comprise pure air, pure water, wholesome food, and clean surroundings.

I would also remark, under the head of fevers, that although the majority of deaths occur from malarial fevers and their complications, yet many deaths occur from other diseases, accompanied by febrile symptoms, and are returned under that heading (fever) because of the defective machinery of the registration department.

Now, taking the group of diseases referred to, viz., cholera, fevers, and bowel complaints, and assuming that improved sanitation is the true remedy, how are we to secure that desired object?

Taking the area of Mysore as 25,000 square miles—and the same arguments will apply to it as to most other parts of India—and bearing in mind that the number of towns and villages to be dealt with is 22,000 or 23,000, the question seems a very large one. But, with some simple, practical, systematised rules laid down, and the area divided and sub-divided, as it now is for administrative purposes, the existing machinery, in the shape of revenue, medical, and engineering staffs, would be capable of doing an immense amount of good with little expenditure of money except that represented by village labour.

To illustrate what I mean, I may state that the province of Mysore consists of eight districts; each district contains nine or 10 "taluks," each equivalent in size to two or three parishes, perhaps, and each taluk divided again into six or seven "hoblis." The district magistrate is in charge of the district, and under him, down to the smallest sub-division, there are officials of varying power and jurisdiction. From this it will be seen that a chain of responsibility can be established from the top to the bottom; and even in addition to the lowest official to whom any power might be entrusted, there comes the hereditary head-man of the village, who can be made a useful auxiliary. In addition to those referred to, there are the doctor and the engineer, whose advice and assistance would be available, even though technical or very skilled advice would be comparatively rarely required.

The principal points to be attended to, at first at all events, are (1st) improving and protecting from pollution the present sources of water-supply; (2) improving the conservancy of houses and streets, and preventing the indiscriminate fouling of the ground in and around villages, improving the drainage—as by filling up pits or holes in which water or sewage is likely to accumulate and stagnate, and cutting shallow drains to carry off surface water and sewage from the vicinity of dwellings, and away from the general water-supply of the place. These are simple rules, and whatever opposition, whether active or passive, may

be encountered at first, would soon disappear as the people come to know the benefits to health and wealth derivable from improved sanitation in their dwellings and surroundings.

What I, therefore, advocate is, that some legislative measures be introduced to provide for village and rural sanitation in India; measures simple and capable of being understood and appreciated by the people, based on the lines of those recently promulgated for consideration by the Government of India. As regards the advice of Surgeon-Major Hendley, that the motto of *festina lente*, be adopted in such matters, I would say, first catch your hare, or, in other words, first get the enactment, and then practise the *festina lente* principle in enforcing it. Do not proceed violently or suddenly, but gradually, judiciously, and with due regard to the prejudices—and, I might say, the apathy—of the people.

The danger in such matters is that legislation is liable to be delayed until completeness and perfection are secured. Far better is it to have even an incomplete measure by which much mortality and suffering may be averted than none at all.

In Mysore, as I think I may say in India generally, hospitals and dispensaries are extending rapidly; even midwives are being rapidly supplied to the rural districts; and every year we see prejudice and apathy disappearing as the people come to understand the benefits procurable from them.

I wish now to say a word or two about small-pox. From the figures I have quoted, you will see that the mortality from this loathsome, yet preventible, disease is very large in the Mysore province, and, indeed, in India generally.

There are great obstacles to be encountered in carrying out vaccination on the voluntary principle there, as, indeed, there would be in Great Britain in the absence of a compulsory Vaccination Act. There are the prejudice and apathy of the people, and, in a few cases, active obstructionists to be dealt with.

The true remedy is a compulsory Vaccination Act, and this, I am glad to say, I have reason to hope the Government of Mysore will soon introduce, with the sanction of the Government of India. In this case also I would advise—first get your enactment, and then practise *festina lente* in carrying it out. In the municipal towns, where vaccination is compulsory, the mortality from small-pox has marvellously diminished. Why, then, withhold this protection and blessing from the mass of the people, from perhaps kindly, but certainly mistaken, notions; a protection enforced in the most civilized countries of Europe.

The cry or objection advanced against it, viz., that constitutional diseases, such as the tubercular, syphilitic, or leprous, may be communicated, by means of the lymph, to the persons vaccinated, no longer holds good in Southern India at all events, as that talented and energetic officer, Surgeon-Major W. G. King, of the Madras Medical Service, has now succeeded in manufacturing a paste made with lymph obtained direct from the calf and lanoline, which is perfectly pure and free from the objections urged against arm to arm vaccination, and which remains good for a considerable time, and is therefore capable of being sent long distances.

Amongst the many other points to which I might refer may be mentioned the absence of any Food or Drugs Adulteration Act, and of any restriction as to the sale of poisons.

Mr. Baldwin Latham, M.I.C.E., in replying to the remarks of Mr. Russell Aitken, said that in justice to the Corporation of Bombay, he ought to state that before the present extensive waterworks now in course of construction were carried out, the fullest investigation was made, and amongst the documents submitted to him (the speaker) when reporting upon the works of the Bombay municipality, was a report prepared by Major Hector Tulloch, R.E., who at present occupied the distinguished position of Chief Inspector to the Local Government Board in this country. In that report the merits of every scheme were fully set out, and preference was given to the works which had now nearly been brought to a successful termination. From a personal inspection of the masonry dam at Tansa, he could say, without hesitation, that it was one of the best works which had been executed in modern times, and it reflected the greatest credit upon the Bombay municipality in inaugurating such a scheme, upon Major Tulloch for his suggestions, upon Mr. William Clerke the engineer, under whom the works had been designed and carried out, as well as upon the contractor who had constructed the work. There need be no fear that any of the evil consequences predicted by Mr. Aitken was likely to arise. He (the speaker) considered it an unfortunate circumstance that Mr. E. C. K. Ollivant, under whose auspices the work was originally undertaken, had not remained Municipal Commissioner to see the great work brought to a completion. He considered it a misfortune that there should be these constant changes in offices of the highest importance, as no sooner had the occupants of such positions acquired the requisite experience, than they were drafted to some new appointment where their former experience might be of little or no value to them.

He would also like to speak a word in praise of the Sanitary Commissioners of India. His extensive connexion with various sanitary works in this country and the continent had brought him in contact with a large number of medical men, but he could say, without hesitation, that the Sanitary Commissioners and Medical Officers of Health of India were most devoted to the prosecution of sanitary work, and possessed a vast amount of information as to the causes and the prevention of disease in that country, and that they would compare favourably with like officers in other countries.

The municipalities of India, in connexion with several of which he had laboured, including the municipalities of Bombay, Calcutta, and Benares, were doing all they could for the promotion of sanitation, and the Government of India had aided them, for in the poorer districts, such as Benares, the Government of the North-Western Provinces had subscribed several lakhs of rupees towards the cost of the construction of works of water-supply and sewerage, and in this good work they had been supported by many of the native princes, and by other wealthy natives who had also subscribed large sums in aid of the prosecution of these works.

In the Native States, too, progress had been made. H.H. the Gaekwar of Baroda had been a most liberal subscriber to the funds of the present Congress. Mr. Dinshah Ardeshir, the municipal commissioner of Baroda, had also largely contributed to the funds of this Congress. In Baroda a large sum of money had already been expended in the construction of waterworks, and only within the last few weeks the Durbar had authorised an expenditure of 18 lakhs of rupees for the purpose of

sewering that city. These facts spoke volumes for the aid which the native rulers were now giving to sanitary progress.

The question of finance, which had been touched upon by Mr. Ollivant, was now one of great importance to all the Indian municipalities. For his (the speaker's) part, he could not see why the Government of India could not do for the municipalities and other local authorities in India what the Government in this country were doing, namely, allow every local authority to borrow money direct from Government at the low rate of 3½ per cent., the repayment of the loan being spread over a period of not less than 30 years. If such money were advanced by the Government, it would be found that they would be absolute gainers, as was found to be the case in this country, for the Government could raise money at a less rate and lend it again to the municipalities and other governing bodies at this rate of interest with an absolute profit to themselves.

With reference to the question of health, it would be observed from the Registrar-General's report for the current week, that Bombay had a very much lower death-rate than many of the capitals of Europe. This contrasted strangely with some other places, both in India and in other parts of the world, and there was no doubt that the sanitary works which had been carried out in towns like Bombay and Calcutta had an immense influence in promoting health, and in reducing the death-rate amongst the people, and every encouragement ought to be given by the Government to the municipalities in carrying out similar works in other cities.

As the question had been raised with regard to the premiums now charged by insurance companies for insuring lives in India, he might say that when, two years ago, he was desirous of visiting India, he made application to the company in which he was insured as to what extra fee would be required to be paid whilst he was sojourning in India, and he received a reply that no extra payment was required. Last year he made a similar application, and was informed that the previous consent covered all future years, and that he might reside an indefinite time in India. This fact, at least, showed that with some insurance companies it was not now considered a dangerous thing to visit these tropical countries.

Surgeon-General Bidie (Delegate from the Government of Madras and from the University of Madras) said;—I rise merely to correct a statement made by Mr. Thornton, that in no jails in India, except those in a particular native state, had the cellular system been introduced. Now I beg to contradict this, and to inform the meeting that in the more important jails the cellular system has been introduced and is at work. I would not have troubled the meeting with these corrections but for the fact that Mr. Thornton based a serious argument on his statement.

Professor K. N. Bahadhurji, M.D. (Delegate from the Bombay Millowners' Association and from the Bombay Medical Society,) said, no doubt sanitation has made great progress in India, but I have one suggestion to make. Its adoption will not entail great expenditure, and will result in great benefit to the inhabitants of towns and cities. All public hygiene takes cognisance of the food we eat, the water we drink, the air we breath. The municipalities take care that our food supply shall be wholesome, and that our water supply shall be kept pure; they should also see that the purity of the natural supply of wholesome air is maintained. No doubt a certain amount of pollution of the town and city air is inseparable from the conditions of town or city life, but that degree of impurity is

easily exceeded, and a great deal of mischief is done. The mortality from the breathing of impure air is very great, greater by far than the mortality from the drinking of impure water. If a systematic analysis of the town and city air were made periodically all the mischief might be prevented by taking proper measures before the impurity reaches a dangerous degree. If regular analyses of the town and city air be taken by the municipalities, and their results made public, they would exercise far-reaching beneficial influences; they will trace the impurities to their sources; they will point out the defects in the conditions and surroundings of not only public places, and mills and factories, but also of the tenement houses. A palatial tenement house in Bombay has its atmosphere fouled not only by the overcrowding which prevails to a great extent in Bombay, and is still increasing, but also by the emanations from the filth and animal sheds below it, by the decomposing garbage in the gulleys, and by the sewer gas which escapes into the house through the holes and inlets specially provided for the purpose by the genius of the plumber. The results of air analysis will bring within the sphere of its operation the plumber, the conservancy and engineering departments, the building laws, and even the mills and factories. It will be seen that the causes of the fatal effects from an abnormal degree of impurity in the air we breath in towns and cities are easily remediable; and I would urge that the municipalities be moved to prevent the fouling of the town and city air, even with the help of legislation. The people at large, who are in total ignorance of the air they breath, would then know what pure air is, and would learn something of the duty which they owe to themselves, to their neighbours, and to their fellow citizens in cultivating habits which will prevent the general fouling of air to which they so largely contribute.

Mr. Osmond (Delegate from the Corporation of Calcutta) wished from his own experience of 35 years spent in Bengal, principally in Calcutta, to emphasize what had fallen from Mr. Thornton regarding the advisability of confining the main strength of our efforts, in the cause of the extension of sanitation, as much as possible to the large towns of India, whence, as from centres, such knowledge would naturally radiate to the surrounding districts through the influence of the upper classes of native society, who, in the case of Calcutta, were already showing their appreciation of the importance of the subject.

Sir William Wedderburn, as Delegate of the Poona Sarvajanik Sabha, then presented and read the three following papers:—

Our Sanitary Wants in the Bombay Presidency.

(*Written at the special request of the Poona Sarvajanik Sabha.*)

BY

Surgeon-Major K. R. Kirtikar, M.R.C.S. (Eng.), L.R.C.P. (Lond.),
Civil Surgeon, Thana, H.M.'s Bombay Army.

The question of village sanitation in India is one of extreme importance, whether it is considered from the point as to what measures Government should adopt, or whether it is looked at from the side of

the governed as to what is needful for them, or what they ask of a paternal Government whose sole anxiety is to make the people happy and healthy. The responsibility of Government in a country like India in legislating on sanitary questions is all the more serious when it is taken into consideration that the governing power comes from a country which, keeping pace with the general enlightenment of modern days, recognises the principle of *sanitas sanitatum, omnia sanitas*, and has to govern in a country where the people governed are of divers habits, due to a diversity of races and religions. In India, though among the higher classes personal hygiene is as perfect as it could be in any civilised country, yet among the lower classes, which form by far the largest portion of the inhabitants, there is so much want of it that it cannot but strike the governing race that legislation in sanitary matters becomes an urgent necessity. Where these lower classes live in villages and hamlets it becomes necessary to enact a code of laws which aim at the removal of the filth which is formed and stored in the villages and their immediate neighbourhood with a tenacity and contentment not unnatural to ignorance and life-long habits formed and fostered from generation to generation.

What is the normal sanitary state of an Indian village? Imagine a collection of low huts, mostly straw-roofed or thatched-covered, with three enclosures of mud-plastered and cowdunged chips of bamboo or of karvi sticks (stems of *strobilanthes*). The fourth side is partially open, to admit of the ingress and egress of the cattle that are tethered in the hut side by side with the human inmates. The cattle generally consist of cows, bullocks, and buffalos, occasionally there are pigs, donkeys, goats, and fowls. These inmates of the hut are in the open air during the day, but at night lie upon the ground beside their master and their master's wife and children. There is hardly a window or an opening for ventilation. The excreta of the cattle lie on the floor or are channelled out and swept into a receptacle at the adjacent corner of the huts, or allowed to accumulate between huts. Much of the fluid excreta sink into the ground floor of the hut. The dung-pit, which is not far removed from the huts, exists as a matter of course in every village, as a final repository for any cattle excreta that may happen to be removed from the vicinity of the huts. These dung-pits are annually emptied as manure for the fields which the villagers cultivate, and are as necessary for agricultural purposes as the very grain they sow. Thus, as useful and unavoidable adjuncts of their calling, the villagers must have their dung-pits as near them as possible. In this, the Indian agricultural classes do not differ from the English farmer, who would store on his farms the contents of the cesspools, and who would have his manure-heaps close at hand. This dung-pit is not far off from the water supply of the village. A solitary well—perhaps two or more—supplies the whole body of villagers. The fluid contents from the dung-pits, following the natural law of percolation, contaminate the water of the well. Close to the well washing of clothes, often filthy rags, without soap, without disinfectants, washing of animals and of men, is carried on from day to day. This ablution water sinks into the soil, eventually to escape into the

well. If there be a tank or a quarry hole in the rainy season, or a well with a flight of steps, whereby men can get at the surface of the water, the washing is done in the water itself. The process of ablution is very characteristic. The man dips his feet into the water, then his hands; he next takes a mouthful of water which he promptly throws back into the water with a sharp scouring of his throat, and the discharge of its mucous contents. Then he washes his body, changes the cloth round his waist, and finishes with washing the same. If the bather is a woman who has come with a ghurra (earthen jar or pot) for her day's supply of water for cooking, drinking, or other domestic purposes, she takes this very water home in as contented and unconcerned a manner as if it had passed through hundreds of filter-beds, pure and undefiled.

Conservancy is equally of the most primitive kind. Human excreta are also not found very far from the water-supply. There are no private privies, no public latrines in small villages. The back yards of huts, near fields, and even gulleys or spaces between and adjoining houses, are used for natural purposes. Children sit anywhere. It is their privilege to deposit their excreta anywhere they like, even in large towns. The excreta are never carried away, but are left to be devoured by hungry cows and buffalos when fodder fails in some seasons of the year, and sometimes when the animals, half-starved on account of their master's poverty, go all over the village rummaging and ravenously devouring what filth they can lay hold of. In a country like India, for eight months of the year the sun is very powerful and acts as a prompt dessicator, thus minimising the evils of the want of conservancy arrangements, especially where the village population is very limited; but in large villages, when such excreta of healthy men and of sick men lie promiscuously within the collecting area of the prime water-supply of the village, the danger to health must necessarily be great. It is this that, in times of cholera epidemics, renders all efforts to give medical relief futile. It is this that tends to keep up the virulence of the disease. It is this that renders an epidemic a source of danger to all, destroying families without check or without choice, as between the rich or poor, the young or old, the sickly or robust.

Such is an Indian village ordinarily. If mortality is not greater, it is solely due to the supervision of the minor revenue officers, goaded on by the moral influence and periodical visits of the higher district officers. There is no special sanitary officer for a village with any special knowledge of or training in sanitary science. The Patel, the lowest revenue officer, with hardly any education, is the general supervisor of the village. Assisted by the Talati, he is the "maid of all work," so to say, of the village. He is the registrar of the vital statistics. Births he registers all right, and deaths likewise, but he has no idea of the causes of death. That is mere guess-work. General terms are used to account for mortality. "*Pôt-Dukha*" is bowel complaint. It may be anything—dysentery, diarrhœa, liver disease, uterine complaints, &c.—causing pain in the abdominal cavity. Fever is a vague term including any kind of febrile complaint, inflammatory,

or exanthematous. "*Wâyu*," is another cause of death; that may be rheumatism or any affection of the nervous system, painful or otherwise. Such is the capacity of our village registrar of deaths. He cannot be blamed for this general vagueness of the nomenclature of diseases causing deaths. He tries to keep the village clean according to his lights. The "Sanitary Primer" of the Government of India, written by Surgeon-General Cunningham, did not exist in his day, at any rate when his notions of things were formed, and he is too antiquated and too unconcerned to begin reading it when probably he has only a few years more to put in for his invalid pension. He is a man quite on the border-land between the early period of British Government and the age of sanitary reform of but a recent date. Add to all these, which I would call *natural conditions* of an Indian village, the abject poverty, and the utter disinclination of the villagers to change their habits, manners, and customs, handed down from time immemorial, and the picture will be complete.

It will at once be apparent, from what I have stated here, where our difficulties in sanitation lie. Sanitary rules may exist, and they do exist. It is the executive we want to carry out these sanitary rules. He must be a man from amongst the villagers; but he must be one who not only himself understands what sanitation means, and how sanitary measures should be brought to the notice of the villagers, and how he should help them and persuade them to carry out those measures, but he should also have an official status which will command respect. He must be a tolerably well-paid minor sanitary officer, just as much as the patel and talati are in financial and revenue matters, though I must admit that I do not consider the patel and talati by any means well paid. These minor sanitary officers must work directly under the Deputy Sanitary Commissioner of the district, or under the Civil Surgeon of the Collectorate. There appears to be no necessity in my opinion for a sanitary board or a *punchayet*. There could hardly be one single hut in the present state of society in a village to furnish a man who understands what sanitation really means. Sanitary measures requiring money from the villages would touch the pockets of the individual members of the board or punchayet, and the utility of important, but costly measures, will be, therefore, underrated and often overlooked. The Deputy Sanitary Commissioner or the Civil Surgeon is the most enlightened and properly educated sanitarian in the district. All sanitary proposals, projects, and undertakings should emanate from him. He is the most qualified to order them, execute them, and control them. As in matters connected with the civil station in which the Civil Surgeon resides, he is independent of the revenue officers, but works with the collector as his sole medical referee, so in the matter of village sanitation he should be the sole sanitary adviser of the collector. This will be only an extension of the Civil Surgeon's present duties in the civil station generally, and what are they? He appears in the Sessions Court before the District Judge as an expert. He assists the jail authorities in either holding charge of a jail or in aiding the Superintendent in all matters con-

nected with the health of the prisoners in the jail. He helps the police by holding *post mortem* examinations in all cases of medico-legal importance. He gives evidence in all such cases on behalf of the Crown. When epidemics break out, the collector always refers to him for special precautions or measures to prevent the spread of epidemics. In the times of cholera epidemics he sends out through the police large quantities of cholera mixture, and he has to keep and distribute a large store of these cholera mixture bottles. When small-pox breaks out, he has to see that the local vaccinators do their work and carry out the work of vaccination or re-vaccination with vigour. If, in addition to this varied work of the civil surgeon, he is called upon to do the work of advising the collector, as Chief Sanitary Officer, on purely sanitary matters other than vaccination and cholera, it will be a real gain to the whole executive machinery of the collectorate. It may be urged that the civil surgeon is a stationary officer, or at any rate is supposed to be so, and will not be able to visit personally all the villages of the district; it will be taking him away from his legitimate work of treating the sick in the station. Suggesting rules and measures in writing from his office, he may do; but travelling into the district from village to village will be practically a physical impossibility, having regard to his urgent daily station work, as also to the extent of the district. That is a reasonable argument and a real difficulty. Then have a regular sanitary officer for each collectorate distinct from the deputy sanitary commissioner. The latter may attend to vaccination alone, for that, it appears to me, is at present the most important work he is engaged on, and it would be a retrograde move to lessen his responsibility or his work in that direction; and having further on to suggest improvements in the system of vaccination, I should keep the present office of the deputy sanitary commissioner entirely intact. The new sanitary officer I propose for the district must make his tour through the district like all district officers, supervising the minor sanitary officer of each village. It may be said that this would mean money. Of course it must cost money to improve the present state of things. Where the money is to come from is a question I need not concern myself with just now, although it is a very important question, and the solution of it must be found if my measure is to be practicable. What I want to bring out in the present paper is the line of sanitary reform which I consider best, and which the State might adopt, having due regard to the insanitary condition of the people and not to their financial state. That is a point for the Financial Advisers of Government to settle. If the State is not prepared on the score of financial difficulties to create the appointment of the travelling district sanitary officer I have proposed, then as the second best suggestion I would say that the necessity of travelling on his part may be dispensed with, and the civil surgeon should, when he inspects the dispensaries, visit some of the outlying villages as he inspects the towns where dispensaries are established. The rest of the villages may be left, as now, to the visits of the superior district officers. What is wanted most is the practically carrying out of the written laws or rules in a stringent manner. That this cannot be done better or more satisfactorily by any

other officer than the civil surgeon or special sanitary officer, goes without saying, as he knows what his orders mean and what scientific sanitation means. Although the superior district officers are men of the widest culture, and sometimes take particular interest in, and try to understand, sanitary questions with an intelligence and sense characteristic of their superior culture, still when the whole presidency is to be administered, it would hardly be fair to expect revenue officers to do what has never formed a part of the calling, or their culture, or what they were never especially expected to administer. *Apropos* of this important question of a non-medical officer of the superior or minor service from one department being called upon to do the work of the medical department, I may allude to one strange custom that exists in the hygienic administration of the district. It is well known that in cholera epidemics in villages, the police constables are called upon to administer anti-cholera medicines supplied to the chief constables of taluka towns by the civil surgeon. This arrangement is as unfair to the policeman as it is often considered to be, or at any rate is likely to be, mischievous to the patient. The poor policeman has no knowledge of the disease and its various stages. He does not know how to nurse a sick patient. Much less can he face a cholera-stricken patient in the agonies of death, cold as a corpse, and yet shrieking with the aches and pains of the living. It requires good nerve at such a time to keep his wits about him, even on the part of a trained hospital assistant. Imagine the tremulous hand of a policeman as he doubtfully doles out his doses of the cholera mixture to dying men. If he is a man given to shirk his work, this is just the time when he would shrink from the cholera patient, and leave him to die without the supposed relief that is concentrated in the bottle. It will be a right step when the policeman is relieved of this serious responsibility. Under such circumstances the minor village sanitary officer whom I suggest will be the proper person to relieve the sufferings of a cholera patient in a rational way, as also to attend to the proper disposal of the excreta of cholera patients—a matter which, I think, requires prior attention for avoiding and preventing the spread of epidemics of that dire disease. At present this important duty is left to the minor village revenue officers, which, I think, is an unsatisfactory and, indeed, actually, a very dangerous arrangement. To leave the adoption of preventive measures in the hands of those who do not understand them, or who do not appreciate their importance, is against all dictates of preventive medicine. With a better arrangement, it is possible our periodical epidemic outbursts of cholera may be brought under proper control, if not absolutely prevented in the near future.

One of the greatest wants of the country everywhere is a pure and plentiful supply of water—water for drinking purposes and water for agricultural purposes. Drinking water must always remain uncontaminated. As in villages so in large towns, water is liable to contamination from soakage of all kinds of filth, especially when in private houses wells and privies stand side by side. It should be the prime care of all Government sanitarians to ensure a copious supply of good potable waters. It is not enough to start waterworks in the principal towns

alone. They should be provided with filtering beds, and all tanks and wells which supply drinking water should be periodically cleansed and repaired in a systematic manner. That the construction of canals for irrigation purposes is an important sanitary measure necessary to avert famines and pestilence, goes without saying. Its importance is practically acknowledged by the State. It was so even in the pre-sanitary era of the Mahomedan rule in India. Looking to the chronology of the Western Jumna canals, for instance, we find that Ferozsha, so far back as 1351 A.D., brought a stream down the channel of the Chitang to Hansi and Hissar. About 1468 A.D. the water of this channel ceased to flow further than the lands of Kythal. In 1568 A.D., the Emperor Akbar re-excavated the work of Feroz, and brought a supply from the Jumna and Soub by the present route into the Chitang. In 1626 Ali Mardan Khán constructed a canal to Delhi from the last-named line. From 1753–1760 the Delhi branch ceased to flow. In 1817 Captain Blanc was appointed to restore the Delhi Canal. Men "parched with thirst" and "having their gardens dried up" were supplied with water in olden days by rulers who were not avowed sanitarians, but who had the natural intelligence to understand what an amount of public wealth and public welfare rested in the supply of abundant pure water. Witness what the wise Akbar declared when he ordered the Jumna Canal to be re-excavated:—"God has said, from "water all things were made. I consequently ordain that this jungle "(Hissar) in which subsistence is obtained with thirst be converted "into a place of comfort, free from that evil." There are places in which waterworks existed in pre-sanitary times. The houdahs of Poona and the tunnel leading from the Shenali Tank to the Jung in Kalyan are evidences of what the Indian ruling powers did in pre-English days.

It seems to me that in modern times the consideration of giving towns and villages an abundant supply of water is a sanitary reform that should not be left to the whims or caprices of village committees or even of town municipalities. It should be insisted on and even carried out by Government, inasmuch as people are not sufficiently educated to ask for such important sanitary measures of their own accord. If they are called upon to do it through municipalities, the majority of members are so far incapable of recognising their own best interests, and so far from wishing to have a good supply of potable water, that they may not pass the measure at all. Every large town should have its waterworks. Where there is want of money it should be borrowed, and posterity, which will in the end be the greater gainer from such works, should be made to contribute, the town handing down the debt from father to son. Such an inheritance of debt from parent to son in any country would not be unjust or undeserved. It is supremely needed in such a poverty-stricken country as India, if any costly sanitary work is to go on at all or to be begun in that earnestness of spirit which its importance demands.

From the foregoing remarks it will be seen that the chief sanitary difficulties in India are want of money and want of special sanitary

officers in each village. With regard to the want of money I have this to observe. The money has to be found either by the Government or by the people. If it has to come from Government it may come from diminished expenditure in other departments, or by fresh taxation for special sanitary purposes. Increased taxation will raise a popular cry, such as is always raised whenever taxation has been increased. It is not my purpose, as I have already said, to enter into this question, though I am sure it will have to be done some day. I have to consider the point as to whether people in their present state of education, or rather want of sanitary and even general education, in their absolute ignorance of the benefits of sanitary measures, and in their apathy, will be prepared to voluntarily contribute to any sanitary measure. The late Deputy Surgeon-General Hewlett, who was for a long time the Health Officer of Bombay and Sanitary Commissioner to the Bombay Government, and whose sanitary experiences are of such a nature as should command the respect of every earnest sanitary inquirer, has said that "if "Government were to order the Collector to levy a rate, there would be "an immediate outcry that it was imposing additional taxation, and "great and widespread discontent would be caused." That this would be so is inevitable, considering the causes mentioned above, viz., the poverty, the ignorance, and the apathy of the villagers, and even of the otherwise educated people in towns. But what is the alternative, or rather the remedy, which Deputy Surgeon-General Hewlett proposes? "There are in the Bombay Presidency," says he, "at least three villages "where the villagers elected their own panchayets who, *with the con-* "*sent of the majority* (the italics are mine), imposed a house-tax on "themselves to meet the expenditure necessary to keep the village "clean. In one of these the movement was entirely spontaneous with- "out any pressure whatever being put on the villagers by any Govern- "ment official." If such a happy set of villages could exist or could be even imagined in the present state of society, Government aid and Government lead would hardly be necessary. But three villages out of near 25,000 villages in the Bombay Presidency afford a very poor spectacle, and just show the reverse of the spirit of municipal self-government, about which Dr. Hewlett seemed to be so sanguine. I have not had the special nor the long and distinguished experience it was Dr. Hewlett's peculiar fortune to acquire during a course of energetic service for over 30 years. But, knowing, as I do, the native frame of mind, the native habits and inclinations, I can positively assert that a sponteneous desire for sanitary measures, not to think of spontaneous action, must of necessity be exceptional. For it to be general, appears to be a matter not even of the distant future. Even in the three villages he alludes to, mark you, the house-tax *was imposed by the majority*. It is possible to imagine that in every village there may be sensible persons; persons who, though not educated in schools and colleges, may yet be intelligent and sensible enough to understand the usefulness or the necessity of this or that sanitary project, but yet they may be in the village in the minority, and may not be able to secure the necessary consent of the punchayet as a body. Sanitation must

therefore of necessity fail. Even in a civilized country like England, where people are better educated, and perhaps better disposed to listen to the voice of reason, where sanitation has progressed from day to day under the guidance of enlightened public opinion, there are people who will not understand that they are doing wrong in opposing important sanitary measures. How is one to expect the ignorant, indolent, easy-going villager to understand the responsibilities of his position as a member of the sanitary board or punchayet, perhaps the sole guide and leading sanitary light in his own little circle? It would be an exceptional phenomenon indeed if he did. Much less can you expect voluntary contributions from him or from his still less enlightened, or still less energetic co-villagers. It must be for Government to lead the van of sanitary reform. It must be for Government officials, who are charged with the responsibility of administering a district fiscally as well as physically, to contrive measures for the sanitation of the villages. There is an old saying, wherever there is a "*gaum*"—(a village, or a "hamlet")—there is a *Mâhârwâdâ*. The Mâhârs of this Mâhârwâdâ are the natural hereditary scavengers of the place. Let these men be paid to keep the villages clean. Let them be held responsible that the provisions of Section 33 of the Bombay Act VII., of 1867, are systematically carried out, and that human and animal ordure or excreta are not allowed to accumulate in the neighbourhood of human dwellings, and that offensive matter from private houses and privies does not escape on to roads and public places; and further, that such channels and depressions as go to feed public tanks are not fouled or converted into latrines. If the Mâhârs are paid to do this work on the just principle that every kind of labour has to be paid for, and particularly that labour where such filthy and by no means agreeable work has to be performed must be all the more willingly and readily paid for, I have no doubt a good part, indeed the major part, of village sanitation will have been achieved. It is within the prerogative of Government to call upon the villagers to remunerate such labour. Persuasion and good counsel may in such a case be coupled with the exercise of authority; it will certainly lighten the burden of the call to remunerate the Mâhâr. But neither counsel nor persuasion is, in my humble opinion, likely to be of any avail where men are stupid and steeped in profound ignorance of sanitary laws and sanitary requirements.

Mr. J. M. Cursetji, District Deputy Collector in charge of Prant Bhiwandi, in the Thana Collectorate, has framed for his talukas about 19 rules for the establishment of sanitary boards without the aid of Government legislation. He has very kindly placed them at my disposal for the purpose of discussion in this paper. They appear to me to be workable. They are reasonable, and may be very usefully adopted, with suitable modifications wherever necessary from the peculiar requirements of each village, in the absence of the arrangement I propose, or in the absence of any measure such as is suggested by the permissive Bombay Act No. I. of 1889, which, as far as this Collectorate is concerned, is a mere dead letter. Briefly summed up, Mr. Cursetji's rules are as follows:—He would have a village committee appointed by

the District Deputy Collector or Assistant Collector in such places as the importance of the place and the general status of the inhabitants demand or will justify. The radius for each committee to be six miles. The committee to meet once a month. Each meeting to elect its own chairman. A report to be made every three months by the secretary of the committee to the Mamlutdar. The Mamlutdar to be personally responsible for supervision over the sanitary committee. Village Máhárs to remove filth, and to be remunerated by the committee. A voluntary cess *per mensem* to a Bhangi to be started for removal of excreta from privies and latrines. The committee to fix proper sites for latrines, dung, and kutchra pits. The committee to look after the general cleanliness and health of the villages, and to arrange for the disposal of the dead. Any violation of the committee's rules to be reported to the Mamlutdar. Committees not to have the power of fining or imprisoning. The Mamlutdar to be the referee where there is diversity of opinion. Committee to meet in the village school-house. Mamlutdar to be appealed to on questions beyond the committee's jurisdiction. The consideration of the water-supply to be left to the district and local boards. Questions of rights of property of individuals or communities not to be enforced unless under the collector's or district magistrate's sanction. Mamlutdar to report six-monthly, or whenever required in special cases. Collector and district deputy collector to have the power of calling for records and of vetoing the resolutions of the committee. Appointment to the committee to be for life; members subject to removal when necessary. Mr. Cursetji's Rule No. 3 is an important one. Members of the committee should be from amongst the non-official element. In this I agree with him, for it lays down the same principle as that advocated by Deputy Surgeon-General Hewlett, who says that it is "unwise and unfair,"—I would myself even add dangerous—"to place magistrates on village committees." The result of such a position would be, he says, that "the same man would occupy the position of accuser and judge." For instance, section 10, Part II. of Bombay Act No. 1 of 1889, called the Bombay Village Sanitation Act, 1889, provides that every magistrate having jurisdiction in the village may take part in the proceedings of the committee at any meeting thereof at which he is present. Section 14 provides that the same committee, which are the accusers, can take cognizance of offences against their own rules, and may convict an offender and sentence him to pay a fine. This is, indeed, a serious matter; and, as Mr. Cursetji observes in his Rule No. 3, this power may be abused by illiterate and ignorant persons forming the boards, although section 15 provides the right of appeal to district magistrates. The man so punished may not be able to appeal. He may not have the time, will, or money to do so. Personal animosities will always find play, and there will be occasional squabbles, which will be scarcely justly dealt with if the minor and major magisterial officers are themselves involved in them.

I may here for a moment make a passing reference to one of the points which the late Deputy Surgeon-General Hewlett has raised in the preface to his "Village Rules," published from the office of the

Superintendent of Government Printing, India, Calcutta, 1889. Especially worthy of notice is this point, inasmuch as he says that his "Village Rules" embody "the observation and experience of a lifetime." It would be presumptuous to attempt to gainsay such valuable experience of the lifetime of an able officer, were it not for the fact that this individual experience is not borne out by the experience of other officers of Her Majesty's Indian Medical Service who have worked in times gone by or are now working in India. To begin with: it seems to me that Deputy Surgeon-General Hewlett is hardly fair to himself or to the Medical Department, of which he was a distinguished and zealous officer, when he says in the preamble of his Draft Village Sanitation Bill that "Government having taken into its most earnest "consideration *the very heavy mortality which year by year** takes "place among the rural population, and finding that *it is due to the* "*extreme prevalence* of disease, especially of fevers, bowel complaints, and "*in some years* of cholera and small-pox in the villages, has been pleased "to determine that in the interests of the rural population committed "to its charge this serious state of things can no longer be permitted "to continue." To say this is to cast on one's own self and on a beneficent Government an unjust and unmerited reproach. I have the very high and unquestionable authority of Sir William Moore in saying that "the improvement of the public health of the natives generally, had ever "been held as one of the most important measures by which the health "of the Europeans sojourning in their midst was to be maintained." If that is so, and I say emphatically it is so, the health of the native public generally could not have been such a matter of unconcern to the Indian Government as Dr. Hewlett considers. The health of the European has not from year to year been subject to such tremendous deterioration as to cause heavy mortality. Nor has there been an extreme prevalence of any disease to such an extent as to warrant the assertion that "this serious state of things can no longer be permitted to continue," as Dr. Hewlett broadly asserts. Take the testimony of another Indian officer of note. Surgeon-General J. M. Cunningham, late Sanitary Commissioner with the Government of India, says, "Already "there are undoubted signs that the people of India appreciate the advan-"tages of sanitary improvements much more than they did, and in many "towns and municipalities endeavours are being made to remove the "causes which have been injurious to public health." This surely does not indicate a state of sanitary affairs which Dr. Hewlett considers "a "serious state of things" that can no longer be permitted. It may be urged that Dr. Hewlett speaks of the rural population only, and that mortality, though not so bad in the urban populations, is yet very seriously bad among the rural districts. From Dr. Hewlett's own showing, it will appear further on that his apprehensions are not borne out by his own statistics. The death-rate for all India was 17·5 in 1871. This was the first year in which the Sanitary Commissioner with the Government of India was able to include the statistics for all India,

* The *italics* are mine.

about ten years after the introduction of measures of sanitary reform for all India. In scrutinising mortality tables we must remember the great principle which is often lost sight of, that the rate of mortality of each year is affected by the birth-rate of that year, and our calculations are usually made from our decennial census returns. The main cause of mortality under such circumstances may be due to a very rapid increase of population, and the proportionate increase in the number of persons exposed to the insanitary condition of a district. Taking Dr. Hewlett's figures as recorded in his Annual Report for 1887 as Sanitary Commissioner for the Government of Bombay, we find as follows :—

Birth-rate per Mille.			Death-rate per Mille.		
—	1886.	1887.	—	1886.	1887.
Urban - -	26·56	27·94	Urban -	25·80	18·33
Rural - -	36·64	39·69	Rural - -	22·79	29·05

Here is a fluctuation. Mortality has in rural districts been neither more than the births, nor has it been year by year on the increase as compared with that in urban districts. In 1886 it was less; in 1887 it was more. The mean ratio of deaths per mille in the whole of the Bombay Presidency between 1874 to 1884 was 24·60. Compare with it the mean annual death-rate of England and Wales from 1871–1880. It was 21·27; and this was in a country where sanitation has been systematically carried on at great expense and improved every year. I have purposely taken these figures at random and not for parallel years, inasmuch as they show no very wide or alarming variation in their respective ratios. Compare with these figures the following rates of mortality in other counties in one of the years between 1871–74, say, the year 1873 :—In Scotland in 1873 the rate was 26·4. In Ireland it was 26·3. I append a table showing the mortality in some of the principal towns of Europe and America in 1872 as furnished by the Board of Health of New York :—

Europe :—		*America :—*	
Paris -	- 21·1 per mille.	New York	- 32·6 per mille.
Berlin -	- 32·3 „	Philadelphia	- 26·1 „
Vienna -	- 31·8 „	Brooklyn -	- 28·1 „
Naples -	- 35·7 „	Chicago -	- 27·6 „
Amsterdam	- 26·9 „	Boston -	- 30·5 „
Copenhagen	- 23·6 „	Halifax -	- 31·0 „
Brussels -	- 22·6 „	New Orleans	- 30·6 „
Stockholm	- 31·8 „	Montreal -	- 37·3 „
Athens -	- 33·3 „	San Francisco	- 17·2 „
Geneva -	- 19·4 „	Washington	- 20·3 „

These figures will, I hope, amply show that, bad as our village sanitation is, our mortality is in no way very remotely high when compared with that of European and American townsfolk living in the midst of costly sanitary administration; and the government of Bombay need not impeach itself "with heavy mortality year by year among the rural population," especially as it has to administer a country which is absolutely poor, and the villagers of which are not dying with any more speed as the result of absolute want of sanitation than the people inhabiting the most civilised quarters of the globe. It does not, however, lessen the responsibility of either the Government or the people to remove all those sanitary defects which form the leading and grave causes of mortality among the rural and urban populations of the Bombay Presidency.

There is yet another point which I would mention as a grave sanitary defect. It is with reference to a crying want felt over the country at large. Would that the stringent hand of a powerful and well-meaning Government would put down the very dangerous and sinful practice of adulterating our milk-supply with water. The British Government is a bringer of peace to India. But when I think of this adulteration of one of our most common food supplies with tainted foul water, carrying within it the germs of cholera and many other dire diseases, well may I exclaim with the Poet Laureate of our day that—

"The spirit of murder works in the very means of life."

Well may I parody his verse and say that—

"The filthy ditch-worms swim to the brim in the poisoned milk."

Some law to prevent this massacre of the innocents is needed. Let India see no more of watery milk, exposing the lives of the unsuspecting to the grave danger of a systematic poisoning of the purest and simplest form of human food, from the young to the old, from the poor to the rich.

One word about the repeal of the Contagious Diseases Act. It is a retrogade move. There may be ultra-moralists who may cry down its re-introduction. To a man of science who would prevent a preventible disease, to a man who has daily to watch and to counteract the ravages of one of the most inveterate and loathsome diseases, it is a matter of extreme regret that sentiment should have so overpowered an enlightened Government as to induce the withdrawal of a law which was as beneficent as it was humane.

Finally, I shall touch one more question of vast importance in India. It is the question of compulsory vaccination. It behoves the Indian Government to make vaccination compulsory. Vaccination has hitherto been voluntary, except in a few fortunate towns. Voluntary vaccination is ineffectual. This is not due, as it is supposed, to the indifference, indolence, or ignorance of the people. People generally, with very few exceptions, like their children to be vaccinated. What they do not like is the parting with the lymph from the arms of their

children. People do not object to vaccination on the score of religion. Very few do so as a matter of fact now-a-days. Bring a calf to their door and they very soon prefer to get their children vaccinated to leaving them exposed to the possible chance of an attack of small-pox—maybe a delayed one, but probably a virulent and even a fatal one. What most people, indeed a vast majority of parents, object to is the production of their children for the purposes of others' children being vaccinated from the arms of their own. This opposition is stronger among the higher classes, who go under the name of Pândher-peshyâs in this district. They think it is below their dignity to be called upon to carry their children to a particular spot for the purpose of inspection by the vaccinator, or for the purpose of removal of lymph from the arms of their children. For having their children vaccinated, that is, for the purposes of taking lymph from the arms of the children of others they would go readily enough; on such occasions they do not stand on any ceremony; the question of dignity does not arise; it is a time of need, for they know that vaccination will render their children secure from the attack of small-pox; but when the time for parting with the lymph of their children comes they forget the principle of "Do unto others as you would be done by." It does not suit their convenience to leave home. Their children are too ill to be moved; occasionally they may be so, but not always in every such pretended instance. This is a great drawback in our present system of arm-to-arm vaccination. Valuable lymph is thus lost, and the vaccinator put to much inconvenience. He has often to put up with a good deal of incivility on the part of the parents or relations of the vaccinated children amongst this class of people. The rural classes are much more civil, manageable, and open to admonition and good counsel. The higher classes are haughty, imperious, and highly unreasonable. They adopt various means to break the vesicles, allow the clear lymph to escape by pricking them with pins or needles, or dab them with cow dung ashes and scented herb powders, such as *abhir*, under the pretext of religious practices which they know no one dare interfere with, but which every grateful and sensible man would postpone, however religious he may be, until after the lymph had been taken in due time, or the child had been inspected by the vaccinator at any rate. But no, he has to render the vesicle useless for vaccination purposes. Hence this practice, which savours of the story of the dog in the manger. As a native of India I feel that this practice of my countrymen is unbecoming their high sense of charity and gratitude, not to speak of the retarding influence it has on our present system of vaccination. It is necessary under such circumstances to visit the parents from village to village, and from door to door, with a calf as is done in some towns at the present moment. Considering that even educated and sensible men have recourse to the tricks mentioned above under the plea of religion and orthodoxy, the former more honoured in the breach than in the observance; considering also, that often among the villagers the fullest advantages of vaccination are not known, and if they are more generous in parting with lymph from their children's

arms, it is solely because the vaccinator's peon, the talati and the police patel literally hunt them out of their huts; considering all this, I repeat, I would discountenance the idea of expecting, or even compelling, by enactment, parents to take their children to a vaccination station for the purposes of arm to arm vaccination. Society is only partially educated. The number of educated men is infinitesimally small—of the women still smaller. They should be driven to sanitary measures not by coercive legislation, but by the other gentler and educative means of persuasion—a method, in my humble opinion, highly potent and morally propulsive. I say, then, that for compulsory vaccination to be received without opposition or disgust by the vast majority of the Indian public in the present state of society, what is absolutely necessary to do is to bring a calf to their very door. That would be a powerful incentive to general and successful vaccination without demur, dissatisfaction, or discontent. It will be a great step in advance if the existing slippery arrangement is dispensed with. It is an arrangement slippery for the people; slippery for a lazy vaccinator indisposed to work, or to stand the vexatious insults of Pândherpeshyâ parents. With a calf at the door all difficulties will vanish—all opposition will be disarmed. Compulsory vaccination under such circumstances will have none of the sting of coercion. All this would mean, however, more expense, a new machinery, a new organisation. It is well worthy of them all.

I have hitherto dwelt upon the share of Government in the adoption or enforcement of sanitary measures. Although I am a firm advocate of the dictum that to the State "*salus populi*" must be the "*suprema lex*," still it forms but half the factor in the well being of a people. To the people in return "*sanitas domi*" must be the "*prima quæstio.*" Surgeon-General Cunningham has very aptly said that "In all matters "connected with sanitary improvement among the general population, "the State may render valuable aid, but much depends on the people "themselves." It is on all men generally, but more especially, I should even say, supremely on men of culture, on men of advanced ideas in other walks of life, on men of light and leading in other departments of social activity and popular advancement, that the responsibility of educating public opinion in matters sanitary also mainly lies. The State is but the agent, society is the material the State has to act on. Society has, therefore, to be prepared to accept and to carry out sanitary measures before the State can have any hope of success. For the masses of the lower classes to appreciate sanitary laws or to understand them, popular education of the lower classes must advance; and when in popular schools the elementary principles of hygiene are taught, and the newer generations grow old, carrying with them the lessons of their younger days, in time they will practically carry out the dictates of sanitary science in their own lives, and as is but natural their sons will follow. But the State, to start with, will have to take the lead, will have to begin the noble work of sanitary instruction in our elementary schools. It is after the sanitary truths shall have been dinned into their ears till they come to believe in

them as self-evident truths that permissive legislation can be of any avail. Just now, side by side with instructing people, Government must be prepared through its officers to carry on the work of village and general sanitation as it has hitherto done with no small success to themselves and benefit to the people. To attempt to do more would be a sure way to disappointment. As yet the day seems to be distant when trained Indian sanitarians will perform the duties which now devolve upon the higher sanitary officers of the Presidency. They have not the same education, though it may be good of its kind and very creditable, considering the educational and instructional appliances of Indian medical colleges. A three months' course of hygiene in an Indian college is not enough preparation or instruction to an Indian youth, while still more serious subjects of medicine, midwifery, medical jurisprudence, and surgery are at the same time engaging his earnest attention. I can hardly credit such a youth with all the knowledge a practical sanitarian requires to fit him for the duties of a sanitary officer. Sanitary instruction will have to be more thorough and systematic before a man can himself appreciate the real importance of the subject. The Indian student, to be a practical scientific sanitarian, will have to be practically educated to appreciate the practical difficulties of carrying out sanitary measures. Then, and then alone, can there be any hope of sanitary principles trickling through him to men of ordinary education, and from these, again, by practical example and personal adherence to rigid sanitary laws in daily practice, to the vast masses of the lower classes to whom the conduct in life of the higher classes serves as a silent but yet not unobserved or uninfluential example.

Notes on the Hygienic and Demographic Condition of India.

(Written at the special request of the Poona Sarvajanik Sabha.)

BY

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The Hygienic and Demographic condition of the people of India may be briefly described under the following heads:—

I. Hygiene.

Water-supply.—Water-supply in India is the most important factor in the causation of disease. The water-supply in this country is, on the whole, scanty and unwholesome. The people are mostly indifferent as to its purity and quantity. The supply is derived from wells, embanked rivers, streams, rivers, ponds, tanks, &c. The wells are built with or without steps. Some wells are provided with protecting parapets, and some are without them, allowing surface water to enter. The water from the wells with steps to descend is often spoiled, as the people wash

themselves and wash their clothes in it, and take the same water for drinking and culinary purposes. This water is thus always impure, containing ova of guinea-worms, and giving rise to fevers, diarrhœa, dysentery, and intestinal worms. The water drawn from wells without steps is usually pure. The situation of the wells is generally faulty, especially in the towns and cities, where the privy and the well are often very close to one another so that percolations from the privy into the well are not infrequent. The water-supply from rivers, streams, and embanked rivers is also contaminated and impure. People generally use the water without filtering it. Some indeed strain it through cloth when muddy, or they add a little alum to it in order to clear it. The fruit of *Strychnos Potatorum* is also used to purify the water when muddy. The use of these purifying agents is, however, an exception and not the rule. In large towns and cities, which are very few in India, some attempt is made to filter the supply of water, but even here the operation is marked by great carelessness. The water from the smaller rivers is generally unwholesome. It contains impurities of various kinds, due chiefly to the impurities of the surface. The supply from the larger rivers, which have sandy beds or rocky banks, is pretty pure in the fair weather; but streams and rivers with muddy banks and beds, and those others which run through jungles and receive large quantities of decayed leafage, are often fruitful sources of all manner of disorders and diseases. Their water contains large quantities of suspended matter, chiefly vegetable; hence the use of this water for drinking and cooking purposes causes fevers, diarrhœa, dysentery, skin diseases, calculi, &c. Intestinal worms, guinea-worms, &c. result generally from the use of pond, tank, and well water. The water of natural ponds and tanks is generally unhealthy owing to the large quantities of vegetable and animal and other surface impurities which flow into them. The water from embanked rivers and streams is also impure from surface impurities, but when it is carried a long distance in canals and exposed to the air and sun, it becomes comparatively purified owing to the deposition of the suspended matter by gravity and friction along its course. In India, many large towns, cities, and villages are mostly situated along the banks of rivers and rivulets. The sewage and other impurities from the habitations, ashes of cremated dead bodies, animal refuse and trade refuse are allowed to flow into these rivers, and the people use the same water for their domestic and other purposes. In some places, the towns and villages are situated on the banks of tanks and ponded streams. This is especially the case in Central India and Malva. In these places, all manner of impurities from the inhabited areas are allowed to flow into these tanks. The animals are watered therein, persons bathe in them, clothing is washed there; and this water, so polluted, is freely drunk by the people. Persons obey the calls of nature in the immediate vicinity of these rivers and tanks. In some holy places, such as Benares, Pandhurpur, Alandi, and others, the river water is rendered most filthy by a large concourse of people visiting these places at stated periods during the year, and large numbers of pilgrims fall an easy prey to cholera. All the fairs,

called Jatras, which are periodically held in several holy places during each year, give rise to epidemics, from the fouling and scarcity of the water-supply. The water from the tanks protected with parapet walls and without steps to descend, is generally pure. These remarks, it is hoped, will suffice to give some general idea of the impurities of the Indian water-supply. Lately, large cities such as Bombay, Karachi, Poona, Ahmedabad, Allahabad, Agra, Calcutta, and Madras have been supplied with pure and filtered water brought from some distance, and delivered through pipes; but such instances are again the exceptions and not the rule. There is thus a paramount necessity for providing an ample and pure supply of water all over India.

Houses.—The next subject which demands consideration relates to the houses of the people and the ventilation therein. Generally speaking, the people of India are badly housed. The houses are built low; the walls are made of mud, burnt or unburnt bricks, or stones or bamboos, or carvee wattle covered with mud and cow-dung. The roofs are thatched with grass and straw. Some houses are tiled; some are roofed over with mud or brick and mortar, supported by rafters or timber. The houses in the villages are generally built apart, having some nominal compounds, built of stones or bricks, or of hedges of living plants or dead branches. The plinths are generally low, so much so that during the rains the floor gets wet and damp. These houses are provided with low doors, and the windows are few and small. In their place, small holes are kept in the walls just to admit a little light; but these holes are generally closed or stuffed with rags during the night to prevent air coming in. Houses in large towns and cities are better built, but the ventilating arrangements in these houses are generally lamentably defective. The food is cooked within the house,—detached cook-rooms are only found in bungalows.

Privies.—There are no privies in the villages; the people go to obey the call of nature out of the village or into the streets. In large villages and towns and cities, people generally have privies. The privies generally form part of the houses; detached privies are few. A most insanitary, injurious, and filthy practice of having privy pits, exists in some parts of the country; Surat, Belgaum, and Dharwar may be cited as instances. These pits are never cleansed, and the foul matter is allowed to ferment and rot in the soil. In former times, occasionally some common salt was thrown over the ordure from time to time as a disinfectant; but since salt has been so dear, as at present, this became too expensive a process, and consequently it has fallen into disuse.

Ventilation.—Light and air are purposely excluded from the houses in the majority of cases. The cultivators and other working people enjoy the full benefit of fresh air during the day, but in their houses they have to breathe and re-breathe this foul air all through the night. This fouled air gives rise to coughs and consumption. When women are confined, they are shut up in rooms almost "hermetically sealed"; they breathe and re-breathe the limited and confined air for months together; the air is further vitiated by a lamp being kept burning in the room

day and night. Owing to these habits, many a woman falls a prey to pulmonary consumption without any hereditary taint. When a person is sick, he is generally confined in a room well closed up so as not to admit any air. Many cases of fever thus become aggravated and end fatally. So the free ventilation of houses and huts is very defective in India. Nor is the street ventilation any better. The streets and alleys are generally narrow and crooked. The rows of houses are built without any aim to secure thorough ventilation. In large towns, the houses are mostly built close to one another without any interspace for ventilation and light between them. The street ventilation is thus almost as bad as the inside house ventilation. The people of this country in their ignorance deprive themselves of the "lung food" so necessary to health, and thus shorten their lives and lose many working days by illness.

Food.—In the matter of food also the people of India are very badly off; owing to general poverty, brought on by various causes, they have generally to pass their days on scanty fare. The frequent recurrence of famine, due mostly to scanty or irregular rain or no rain, has brought about a great deterioration in the physique of the people, besides causing immense mortality in the years when famine prevails. The people live chiefly on grain and vegetables. Animal food is used by some people, but sparingly, as they cannot afford to have it daily. The staple food in some parts of the country, such as the North-West Provinces and Central India, is wheat; in the Deccan, it is bajree and jowaree; and on the sea coast, rice. Milk and ghee, which were once abundant and cheap, and were largely consumed by the people, have now become dear and scarce owing to the dearness of fodder and the want of sufficient grazing lands for the cattle. The restrictions put of late on the grazing areas have had a very injurious effect on the health of the cattle, and have still further stunted the supply of milk and ghee which once formed a principal part of the dietary of the people. The food-supply of the people, however, is not a subject which can be properly dealt with in the Congress, as it is beyond the reach of public measures of relief, except in times of famine. There seems to be no necessity, therefore, of enlarging on it in this paper.

Clothing.—The poor people continue generally in a state of half nudity. Even the cultivating and neighbouring classes are very scantily clothed. One blanket, a covering for the head, and a strip of cloth about the loins, constitute too often the only clothing of the male population; while a long cloth, called *saree*, and a covering round the chest, called *cholee*, constitute the dress of the females. As for bedding, "the "blanket, which you generally see the cultivator carrying about with "him, is his all in all." He uses one half of it as his bed, and the other half covers him at night. He uses it as his hooded cloak during the rains, and as a covering against the biting winds in winter. When he goes to the market, he uses it as his corn bag; and on great occasions, and if a great man comes to his hut, he spreads it on the floor in lieu of a carpet. The female cultivator does not fare better than her husband. Her *saree* generally serves as her only covering at night, if she happens

to have no ragged blanket to use as a bed. The poor children go about as naked as when they are born, and very rarely get any clothing. They are generally half-starved, and they rarely have a strong and healthy look. The bloom of health, which the cultivators in other countries have, is conspicuous by its absence in India.

Drainage.—The drainage of surplus waters in hilly and mountainous countries is naturally effected by rivers, brooks and declivities of hills. It is generally good; but in low-lying districts, the drainage of villages, towns, and cities, and of the plains cultivated with rice, is generally defective and injurious to the health of the people. Indian villages, towns, and cities are generally built on the banks of rivers and streams, with the object of securing a plentiful water-supply at hand; hence many of the villages and towns, with a very few exceptions, are built in low-lying districts, along the banks of rivers, in valleys, and at the foot of the hills. The prevalence of malarious fevers among the generality of the population, such as agues, remittent fevers, brow-agues, &c., is the natural consequence of this defective location. These malarious diseases prevail largely in rice-growing districts and in jungly tracts where copse wood abounds. The land is generally formed by the disintegration of trap and basalt rocks and granite mixed with vegetable debris, which accounts for the prevalence of malarious diseases. Even the gravelly and chalky lands are rendered unfit as eligible sites by reason of their being mixed up with vegetable matters. Wherever the natural drainage of a district is defective, malarious fevers to a large extent prevail there. In the rice fields, where water has to be dammed up by embankment for the growth of the plants, there is no underground drainage except what may be provided by the nature of the soil, and malarious fevers are the consequence. The villages, towns, and cities, except a few of the latter, are very badly drained. Artificial drainage there is none in the country, and even the natural drainage in the shape of the soil and conformation of the ground is interrupted by irrigation canals and roads and bridge-works in many places.

Burial grounds.—Most of the Hindus burn their dead to ashes, which are then thrown into rivers, streams, and tanks. This is a most salutary practice. A few Hindus, however, bury their dead. The Mussulmans, Christians and Jews also bury their dead. In villages, the burial grounds are generally at some distance from the inhabited areas. But in large cities the burial grounds are situated in the heart of the town. They act injuriously on the health of the population. They defile the air by effluvia arising from the crevices of the tombs or graves, and they contaminate by percolation the waters of the wells situated in the neighbourhood of the burial grounds.

The prickly-pear.—The prickly-pear round about villages and cities and towns, especially in the Deccan, has outgrown its proper limits. Though useful as a hedge-plant, when properly trimmed up, it has now grown to a most injurious extent in a great many places through the carelessness of the population. This exuberant and uncontrolled growth of this plant affects the health of the people injuriously.

Roads.—Since the advent of the English, the construction of cart roads, trunk roads, bridges, railways, &c., has done much to improve the sanitation and trade of the country; yet want of common cart roads in rural districts and out-of-the-way places throughout the country is acting most injuriously on the health of the population and of cattle.

Cattle-housing.—The practice of housing cattle, horses, asses and pigs in the dwelling houses prevails largely throughout the country in rural districts. The practice facilitates the communication of disease from man to beast and from beast to man.

Demography.

Drinking habits.—The people are generally sober, but the vice of drinking, which existed formerly in the country to a very limited extent, is latterly making rapid progress, and ruining many a family, poor and wealthy alike. Contact with western civilization has given it a new and aggravated phase. The well-to-do people have commenced to prefer, and are largely consuming foreign liquors. The vice of smoking and chewing tobacco is also widely prevalent in India. The use of tobacco as snuff prevails widely. All these uses of tobacco prove injurious to health.

Opium is largely eaten and smoked in many parts of India, especially in the Panjab, Rajputana, Malva, and Kathiawar. The habit is very injurious to health. It invariably produces a sort of mental depression. As a rule mothers give their children small doses of opium to lull them to sleep, though the habit is dying out on this side of India at least. When the children grow up, the effects of the poison are not altogether obliterated.

The use of Indian hemp or *ganja* or *bhang* among a large portion of the population is also very common, and has a very deleterious effect on the physique and morals of the people. Insanity in many cases is due to this habit. The mental deterioration produced by the use of *ganja* has turned many a person into an itinerant beggar.

Venereal disease.—The spread of gonorrhœa and syphilis is on the increase in large towns and cities, and even the poor villagers are not wholly free from it.

Bathing and cleanliness of the skin.—The people, as a rule, bathe daily, especially the Hindus, but the bathing is merely nominal, and not thorough. Hence they suffer from skin diseases.

Bodily exercises.—Walking, running, riding, swimming, wrestling, fencing, and other gymnastic exercises, such as swinging club exercise, playing with bat and ball, and various other amusements, are all popular forms of outdoor and indoor exercises. The outdoor exercises are not systematically practised, except by those who resort to the gymnasiums called Talims. The higher classes are not equally well off in this respect. Want of exercise in those whose habits are sedentary, such as shopkeepers, traders, clerks, &c., acts perniciously by producing such diseases as chronic dyspepsia, piles, &c.

Polyandry prevails on the Malabar coast amongst a caste called Nairs. Polygamy also prevails to a slight extent amongst the Hindus and the Musulmans. Both the practices are highly injurious to the growth of a healthy progeny.

Early marriages and unequal marriages, i.e., marriages performed when the disparity of age between the man and the woman is great (*e.g.*, the marriage of a bride of 10 years with a bridegroom of 50 or more) have also a large influence in deteriorating the races by whom they are practised.

Quarrels.—The mention of domestic, civil and public quarrels would appear ludicrous in this place, as they necessarily exist in India as well as in other countries on the surface of this globe, and perhaps have common causes; but since they acquire a peculiar character in India from the existence of caste systems and heterogeneous religious systems, one cannot help mentioning them as they have a most baneful effect on the body, mind, and conduct of the people.

Jatras and fairs. — Pilgrimages to Benares, Prayaga, Gaya, Dwaraka, Jaggannath, Haridwar, Rameshwar, Dakur, Pundharpur, Amrutsar and other places entail hardships on the pilgrims, besides inflicting on them the misery incidental to travelling by slow stages on foot or in country carts. The water is almost always dirty and filthy at these places. No matter how filthy the water at the holy places may be, the pilgrim delights to bathe in it and drink it with the object of washing off his sins and attaining heaven. Many diseases of an epidemic type, such as cholera and malignant fevers, &c., break out at these Jatras and are spread over the country through infection by the returning tide of pilgrims.

Fasting.—The habit of observing fasts several days in a month amongst the Hindus, and especially among the women, in propitiation of some imaginary deities, is very common. They eat on fasting days ground nut, red potatoes, sweetmeats, fruits, &c. and suffer at times a great deal from diarrhœa, dysentery, dyspepsia, &c. This habit undermines the health of the persons who observe these fasts.

Caste system has prevailed in India from ancient times. It has wrought evils of great magnitude among the population. It prevents the unification of the different races, and sows the seed of hatred and enmity throughout all the land. It restricts men in the choice of their profession, and in forming marriage alliances. It has demoralized the people, and has checked the intellectual growth of the population.

The doctrine of Fatalism prevails among the population to a most injurious extent. They believe that everything is decreed by fate, and, no matter what precaution man takes, things will not fail to happen as has been pre-arranged by his destiny. These doctrines prevent many people from adopting precautionary measures in cases of dangerous diseases, or on the eve of great natural calamities. This fatalism has acted injuriously on the mental and bodily condition of the people.

Idol worship.—Hindus, properly so called, are idol-worshippers. They worship idols, representing the so-called incarnations of Vishnu,

such as Rama, Krishna, and Parsharam, and of heroes, such as Hanmant, and Khandoba, and of holy saints, such as Tukaram, Dynaneswar, Namdey, &c. They also worship trees, such as Tulshi, Pimpal, Oudumbar, and also animals, such as cows, bullocks, monkeys, mice, and serpents. This practice has prevailed from times immemorial. It has perverted the minds of the people, and has debased their intellect. It has checked the growth of civilization amongst them. It has retarded their progress in every department of the human life. Whatever pleas the old fashioned learned Hindus may bring forward in support of idol worship, whether on religious, philosophical, or moral grounds, there can be no doubt that idol worship has not only demoralized the people to a fearful extent, but has acted injuriously on their minds, and even on their physical well-being. The observance of this idol-worship with its concomitant evils, such as fasting and feasting and bathing, and other debasing practices, has proved most injurious to the mind and body of the people.

Demon worship.—This practice is very common in India, especially among the Hindus. The fear of the devil causing harm and disease is a common belief. Various idols such as those of Mhasoba, Vethal, Bhoollanath, Asra, &c. are worshipped, and sacrifices of goats, sheep, cocks, cocoanuts, &c., are offered to appease the imaginary wrath of these imaginary devils. A good deal of harm is done to the people, and large pecuniary losses are sustained by them through this belief. The fear of the devils has a most pernicious effect upon the mind and body of the people, and not a few fall a prey to this imaginary fear. The idol and demon worships are a bar to civilization.

Enforced widowhood.—This evil practice obtains among the upper classes of the Hindu society. It has entailed upon the poor widows an amount of untold misery. It has produced demoralization, crime, misery, and disease. The practice of observing fasts is very common among the Hindu widows. Poor widows eat on the fasting days parched grains, ground nut, and fruits, and suffer at times terribly from the effects of this self-denial. The unwholesome food generally produces dyspepsia, diarrhœa, and dysentery. The widows are allowed to eat only one meal a day; they are prevented from wearing good and sufficient clothing; and they are obliged to observe all the fasts prescribed by the Hindu religion. The prohibition of widow-marriage among the higher castes causes a large section of the female sex to be virtually useless for the promotion of household happiness and in the multiplication of good progeny.

From this brief summary of the Hygienic and Demographic condition of the people of India, the necessary measures for the removal of the defects in these two conditions become self-evident. Government has effected a great deal in improving the insanitary condition of the country by establishing municipalities in cities, towns, and large villages. They have netted the country with railways, made roads, and built bridges. The Bombay Government has recently passed a Village Sanitation Act, from which much good is expected in rural areas. They have besides introduced sanitary primers (in English and in the

vernaculars) into schools and colleges. The epidemics of small-pox which were formerly very frequent and virulent, have been brought under control by most elaborate and efficient vaccinating departments, kept up and maintained all over India by Government. Government are also trying to diffuse a knowledge of the laws of sanitation in the country. The missionaries also have done a great deal of good in this direction. They are teaching the people, wherever they can, the simple rules of health—the necessary conditions of physical well-being. The great problem in India, besides having a sufficiency of pure water, good drainage in inhabited and cultivated areas, removal of excreta and other filth from dwelling houses, good ventilation of houses and streets, good roads, good privy arrangements, &c., is to modify the climate of the country which is so hot and inimical to health. There is only *one* way of doing it, viz., by planting as many tall trees over the arid plains of Hindustan as can possibly be done by public and private agencies.

The Sanitary Condition of the Towns and Villages in the Bombay Presidency and the means for improving the same.

(*Written at the special request of the Poona Sarvajanik Sabha.*)

BY

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The attention of the Government of India has been of late more and more drawn to the sanitary condition of Indian towns, on account of the quarantine restrictions imposed by foreign powers on the commerce of he country. A great deal, no doubt, is being done for the improvement of the general sanitary condition of our large cities, but the apathy and habits of the people are so inveterate in certain matters that the question of sanitary reform in India is not one which admits of an easy solution. In this paper an attempt will be made to show what these varied circumstances are, and to give a general sketch of the sanitary condition of our towns and villages, with a view to its being fully realised by those members of the Congress who may never have visited India.

Situation and soil.—In India, as in almost all other countries, the sites of cities and towns seem to have been chosen chiefly from considerations of defence against inroads from without, and close proximity to fresh water.

In not a single instance has it happened that these sites were selected on grounds of sanitary advantages or facilities, hill sanatoria excepted. As a consequence of this neglect the choice of the site is generally very unfortunate. The low-lying banks of rivers, or open plots at the foot of the hills or in the wide gorge of a valley, liable to flood—these are the situations where most of our towns and villages

have been built. As a matter of fact, many towns and villages often seem to have been erected on what were formerly swamps, river beds, or ruins of old cities. They have been so built as to shut out the breezes all the year round, instead of allowing them free access to sweep off miasmatic poisons. In many cases a wall is built all round the town or village, once very useful for protection, but now positively harmful. It is hardly necessary to enumerate the different diseases which go to swell the mortality returns, and which are directly due to emanations from bad soils. The red soil formed by the disintegration of granite, and made more unhealthy by rank vegetation of the forests in the Konkan; the "Cotton soil" of the Deccan, very absorbent of water, formed by disintegrated basalt and trap and supposed to be retentive of, if not generating, the cholera poison; the alluvium brought down by the Tapti, Narbuda, Mahi, Saburmati, Indus, Ganges, Godavari and Krishna and other rivers of this peninsula, with a clayey laterite substratum, exposed to heat and the winds and the rains; the immense marshy tracts of the Runn of Cutch—these ingredients of the soil have greatly favoured the insanitary condition of our towns and villages. The process of decay and corruption has gone on unchecked for ages, so that large tracts have become the permanent home of malarious fevers and of cholera and other bowel complaints generally. A great deal, no doubt, can be done by costly works towards mitigating the evils arising from the conditions enumerated above, by scientific drainage of storm-floods and sullage and fæcal matter; but with the poor resources which are available, the entire extirpation of the evils due to bad selection of sites would be too Herculean a task to be attempted with success in a generation or two. The ground in and round about towns and villages is always uneven, and rendered more so by the people digging pits from whence to take earth for building houses. No care is taken to fill these holes, and they become receptacles for foul water, filth, garbage and ordure, and the waste waters of the cook and bath rooms. These inequalities in the ground are generally resorted to by the people for natural purposes.

Roads.—All villages and towns have roads of some sort, but their shape and width are generally not in proportion to the requirements of the place. Very few are open thoroughfares permitting free ventilation; such of the cities as are walled for protection against inroads—and their number is not small—are often nothing better than hot-houses or enclosures of stagnant air by reason of blocked up roads and the paucity of approaches left for free circulation from without. The streets are generally not straight and wide enough to allow of free ventilation. The Government have constructed good trunk lines of roads, and the local boards and the municipalities have of late been exerting themselves to make some good roads within the limits of the local jurisdictions; but such attempts are generally directed more towards the metalling of roads than towards making them straight and sufficiently wide. The Government and the local authorities have been encouraging the planting of trees along the road sides. They are undoubtedly a comfort to the wayfarer in the hot season, but it may be doubted whether they are not

positively harmful in towns, cities, and villages, as they injure the road surface by droppings from their leaves, and their shade keeps the roads from drying properly. This imperfect drying promotes the decomposition of organic matter, which is always found to a very large extent on thoroughfares, and the consequent exhalation of effluvia. Another great defect of Indian roads and streets is that they are constantly sending out clouds of dust in all directions, to the great annoyance, and often affecting the health, of both householders and wayfarers in diverse ways. This great evil is partially met by watering the streets in small places by private efforts, and on a large scale in many municipal towns. Road watering, however, is not an unmixed good, as it promotes the decomposition of all organic matter, in which respect the warmth of the Indian atmosphere plays no unimportant part.

Dwellings.—Even in large presidency towns and cities, rules for the proper construction of houses do not exist, and, wherever they do, they are seldom observed or enforced. The necessity of choosing a healthy site for building a house, and of providing facilities for the free circulation of air and effective drainage is very seldom recognised and attended to. They are generally built in blocks close to one another, so that the houses receive fresh air from only one side. The width of streets and lanes is often so small as not to admit free light and air into the dwellings. The only ventilated openings in these habitations are small-sized doors and windows, which too often admit only stagnant air, loaded with all sorts of impurities, and never drive it out. In country places, houses possess yards bounded by a brick or mud wall, which keeps the inside air very foul. A large number of houses in these places are very old and ricketty. Over a large part of the country there are no tiled and sloping roofs, but a flat layer of earth overtops the house and presses it down. Openings in the way of skylights in the roof to allow the foul air and smoke to pass out are seldom seen. In the Konkan and near the Ghauts, at the front or back of the houses there are generally to be found dense masses of vegetation—the delight of the owner. There are the cocoanut, the jack, the mango and other fruit trees, and creepers coming down to within five feet of the ground, and displaying within their meshes gourds of various kinds. Where open spaces exist round about a house, they are very often surrounded by a fence of prickly pear or wild cane growing in luxuriance, and inviting or concealing filth and rubbish of every kind. The plantain tree and Alu (*Arum campanulatum*) are the great favourites of the people. In short, anything that can be reared for food or fuel is cherished and stored within the compound. It need not be said that all this vegetation keeps the soil damp, and near the house you have oftentimes dunghills of refuse matter and manure, or dung-cakes fixed to the wall to dry for fuel purposes. To crown the whole, cattle are kept tied up in verandahs or in the inside of dwellings, and a privy, sodden with organic filth, is located either in the verandah or in some other part of the house. In many cities the privies are found near the entrance of the house, and are ranged on both sides of the street. In many big towns in Gujerat and the Deccan, a latrine can very often be seen in front of houses

with a cook-room by its side, and a bedroom over it. The sanitary condition of the huts of the poor is even worse. They measure hardly 15 by 10 feet, are low, without plinth, deficient in light and ventilation, damp, closely thatched, the walls and floors made of mud, with only one door for ventilation and ingress. Here the occupant lives with his family of about half a dozen, with also a few heads of cattle and poultry. The solitary door is always closed at night, and if there is luckily any crevice in the wall, it is carefully blocked up in case of sickness. There is always a place reserved somewhere close to the hut of the poor or to the dwelling of the well-to-do, which serves as a pit in which all cattle dung, ashes, and house rubbish is collected for one whole year, to be removed to the fields for purposes of manuring. Those that have no fields of their own derive a small income from this stuff.

The waste water of the house, loaded with impurities from washings of clothes, and water from cooking and urinals, and ablution water from privies, where any exist, are allowed to soak into a pit close to the plinth, and thus pollute the ground in and outside the dwelling. The question of the disposal of this dirty water is one which does not admit of an easy solution. Besides the difficulties created by the inveterate habits of the people, and their want of appreciation of the benefits of improved sanitation, there is the difficulty caused by their extreme poverty and resourcelessness.

The removal of excreta.—By this is meant solid excrement from bowels and liquid from kidneys. The people of India, being great consumers of starchy articles of diet, pass every day a much larger quantity of solid fæces than the standard of 2½ ounces mentioned by English writers on hygiene. The present writer, when health officer of Poona, found that for all ages and both sexes, the average excretion per day of 24 hours was not less than 10 ounces avoirdupois of semi-solid fæces. These investigations have been confirmed by Dr. Hewlett, of Bombay, and by Dr. Fawcett, of the Alipur Jail. The removal of both solid and liquid human excrement is a *quæstio vexata* with those who have to deal with the conservancy of Indian towns and villages. As stated above, holes and inequalities in the ground round about dwellings are resorted to for purposes of evacuation. River banks, rivulets, and water courses are similarly used for this purpose. Those that have travelled in India could not have failed to see every morning a number of people turn out of a city or village for this purpose with a small pot full of water in their hands. The practice, insanitary and indecent as it is, is good in one respect, viz., that it removes a large quantity of excreta outside the city or village, which would otherwise have polluted the soil, water, and air of the place. The local authorities should take care to provide outside large cities suitable latrines, or, if funds do not permit, to dig shallow trenches, screened for decency's sake, and set them apart for men and women separately. These trenches, moreover, should be to the leeward of the place they are intended to serve, and should be closed, when they are half full, with fresh earth, and new ones dug by the side of the old. This experiment has been repeatedly tried and found to answer

well. The plot of ground so utilised should be ploughed after six months, or, if water is not available, before the monsoons every year, and garden vegetables planted thereon. The crops thus reared are very abundant, and grow vigorously, and repay all trouble and expense. One or two sowings render the ground again fit for similar use. This arrangement, however, does not remove all difficulties. Children will not go to these places, which must be located at some distance from inhabited areas and yards, and holes will be resorted to at night. Removal by hand must therefore be had recourse to, to prevent the soil, water, and air from getting contaminated. The arrangements of trenches will suit rural areas only, but the case of populous cities is quite different. In these places there are generally privies attached to each house. Of these the most objectionable one is the "well privy," which, in many places, still exists attached to the dwellings of even well-to-do people. It is nothing but a pit sunk in the floor of the house for receiving human excrement, which is only after long intervals—or never—removed. It need not be observed that these pits contaminate the wells in the city, and fill the atmosphere with their pestilential gases. There are other kinds of privies in which are placed receptacles which are generally bamboo baskets. These allow of a great deal of percolation. It has been ascertained with tolerable accuracy that nearly one-half of the contents of the baskets sink into the soil underneath before they are emptied. The emptying is a most filthy operation. The scavengers are generally in the service of the house owner, and are a most troublesome lot of people to deal with. Wherever municipalities exist, they are somewhat amenable to discipline; yet they are, as a class, most careless, and therefore the removal of filth in large municipal towns is always very indifferently done. They have been often detected emptying their loads into rat holes or on some rubbish heap. The scavengers have a monopoly of their profession; no other caste, however low, will descend to compete with the Bhangees, who are generally natives of Gujerat or of the North-West Provinces. In places where their number is very small, the people are entirely at their mercy. The slightest attempt to exact work from them is answered by a strike, which means stagnation of filth for days together. Notwithstanding these defects, the hand-removal system of house-to-house service, when placed under the supervision of conservancy inspectors and their assistants, has effected great improvements in the sanitary condition of many large towns where it has been introduced. The system is very costly, and therefore difficult to introduce in all places. It has been proposed to induce the Bhangees to come and settle in places where their services are required by making gifts to them of lands for cultivation and building. The proposal, no doubt, is a good one, and deserves a fair trial.

The dry-earth system has been often suggested as the best solution of the difficulty. Howsoever successful it may be in asylums and jails, whose perfect control exists, it will not do for all Indian towns. The quantity of dry earth required would be enormous to take up 10 or 12 ounces of solid and 40 ounces of liquid excreta, together with about a

pint of water used for ablution per head of population. The cost of collecting, drying, and distributing earth required to dry this large amount of solid and liquid filth, and that of its ultimate removal and renewal, would be simply prohibitive. Anothes method suggested is the System Goux. This system will not, however, do for large cities. The difficulties in the way of procuring sufficient absorbing and disinfecting material for a large quantity of liquid filth in Indian closets would, without doubt, be very great, leaving aside the question of cost and the ultimate disposal of the contents of the tubs.

In the case of the larger towns, where sufficient money and an ample supply of water are available, the water carriage system of removing excreta is the best. The experience of that system in Calcutta and Bombay, though even now the sewers are incomplete, justifies the conclusion that water-closets of simple construction best suit the prejudices of the natives of this country. Natives have an aversion to the person of a scavenger, and suffer in consequence a good deal of filth to collect in and about their dwellings. The system of removing excreta by waterflow in underground drains and sewers is the cleanliest and the most economic system in the long run. It is pleasant to find that the foolish opposition that once threatened to be formidable against the system of underground drains is fast dying out. It had its origin in overdrawn descriptions of outbreaks of typhoid from badly constructed sewers in England which now and then appear in newspapers. Some of the Native States, such as Baroda and Hyderabad (Nizam), and some municipalities, have wisely voted large sums for the sewerage of their towns. The designs must be made only by sanitary engineers with the most recent drainage experience. Sanitary engineers, as such, are almost conspicuous by their absence in India, and it would be a wise step on the part of Government to provide at least one consulting sanitary engineer of ability for each presidency.

Water-supply.—The chief sources of water-supply to Indian towns and villages are rivers, lakes, springs, wells, and tanks. All these are natural reservoirs of the annual monsoon rains. Besides the mineral and vegetable impurities common, more or less, to many sources of water supply, the greatest source of contamination in India is human and animal excreta. It is a common thing to find on the banks of a river or tank, which is the chief source of the water-supply of a place, bathing, washing of soiled clothes and of cattle, and the cleansing of cooking utensils going on simultaneously with the filling of water vessels for domestic use. The surface wells and rivulets are rarely free from the effects of soakage and overflows. Strict supervision must, therefore, be provided for detecting and remedying these evils wherever they may be found to exist. The scanty water-supply of many cities and villages in India gives rise to many skin diseases and bowel disorders, and consequent ill-health amongst the people. The increase of the water-supply is a most difficult question to solve in many places, but much is being done of late by sinking wells, and where funds can be made available by bringing water from great distances by canals and iron pipes. The, conservancy of wells and tanks requires greater attention than is at

present given to it. The wells are almost always exposed to rays of the sun, which promote the development of vegetable matter and loss by evaporation. The other evils attendant upon open wells and tanks are that the water is never cool and bright, and that there are always chances of foreign substances, such as dust, leaves, and decaying animal matter getting into them.

Tanks, wells, and cisterns get contaminated by the dipping of buckets into them. One very often sees a water bearer scrubbing his water vessels with dust, cattle dung, or ashes near a well or cistern, and cleaning the same by dipping them in the water, which he afterwards fills his vessels with to carry home for culinary use or to drink. This foul practice can be very easily and successfully put a stop to, either by fixing pumps to public wells and cisterns, or by providing dipping vessels suspended with chains for drawing water. If the space round about be flagged or paved, and the waste water led out by proper drains, and people prevented from bathing, washing, or cleaning vessels near them, the water of wells and cisterns will always remain clear and sweet.

Food-supply.—The staple articles of diet in India are grains of various kinds, and are so simple, that complex legislation is not required to maintain their purity, except in very large commercial towns. Grain is ground into flour in each homestead, and, therefore, it is free from adulteration. Rules are, however, required for ensuring the purity of milk, and of clarified butter (ghee), which are very often adulterated, the former with impure or tainted water and flour, and the latter with fats of different animals, starch, &c. Meat, which is more an article of luxury than a principal substance in the dietary of the people of this country, requires strict supervision. It is very inferior in quality, and often mixed with flesh from carcasses of diseased animals. Fish, which is the principal article of diet with the non-Brahman population of the sea coast, is found very often in different stages of putrefaction due to want of care on the part of fishermen, and to the very high price of the salt required for curing, caused by the great enhancement of the salt duty in India.

Disposal of the dead.—The question of the disposal of the dead has of late been attracting the attention of sanitary authorities all over the world. The practice of cremation is no doubt a very good one, and has been largely followed in India from times beyond memory. Very often, on account of carelessness, or from want of sufficient fuel, cremation is imperfect, and half-burnt limbs and imperfectly calcined bones are not infrequently seen on cremation grounds, or thrown stealthily into rivers. It is a matter of regret that first-class municipalities, such as those of Calcutta, Bombay, and Madras, have not yet succeeded in erecting suitable crematoria. There are no fixed rules for the burial of the dead, and intramural burial is very common. Grave yards are to be seen in the midst of populous centres within a few yards of dwellings, on the banks of rivers and lakes, and close to wells. For fear of wounding the feelings of the people, no attempt is made at closing these burial grounds. Even the rules for the burial of dead

bodies are conspicuous by their absence in a great majority of places, and where they do exist they are generally a dead letter. The Parsees are allowed to expose their dead on Towers of Silence. Carcasses of dead animals are seldom buried, except in large cities. They are generally exposed to be devoured by vultures and wild animals. The practice of water burial can be seen on the banks of sacred rivers. Old ascetics—*sanyasees*—are generally given a water burial. Their dead bodies are immersed in deep rivers with a heavy stone tied to them. This practice ought to be put a stop to, as very often on the third or fourth day the body, disfigured by putrefaction and river fishes, can be seen floating with a number of crows feasting upon it. The practice of the burial of still-born children in the rooms in which they are born has not as yet attracted sufficient attention even in large cities.

Objectionable Trades.—These add to the impurities of the atmosphere, and therefore are deserving of notice. The pungent and irritating fumes from brick, pot, and tile burning are familiar to many. The fuel used in this trade is generally stable litter and city rubbish. The trade is very often carried on in the heart or on the outskirts of cities and villages, and its surroundings are generally very filthy. Burning of limestone for mortar is another objectionable trade, frequently carried on in the midst of crowded localities. The slaughter of animals is very often made close to busy centres of population, and blood and offal are frequently thrown into the streets. Well-built slaughter-houses are found in only a few of the larger municipal cities. Small tanneries exist in many places, and the curing of small skins is done by almost all shoe and leather-goods makers of this country at their own places of business. Other objectionable trades generally found in Indian cities are those of the milkmen, who keep horned and milch cattle. Their stables, even when kept by private individuals, are most filthy. The liquid dung and urine are allowed to soak freely into the ground. The insanitary condition of these places is always a fruitful source of rinderpest and other cattle diseases, which destroy thousands of cattle every year in India.

Sheep-pens and pig-sties, kept by low caste people, though not as great nuisances as the preceding, require serious consideration from a sanitary point of view. They give out a peculiar penetrating odour, which is very sickening.

Horse and pony stables, kept for hackney purposes in large cities, are as bad as the cattle pens; no precautions being taken for the proper removal of dung and urine, which is allowed to sink into the ground.

Other objectionable trades are those of collecting and storing bones, horns, and hoofs of animals; melting of tallow; dry fish and hide stores; skinning of dead animals, &c. The effluvia arising from these trades, which are now and then carried on in many cities and rural districts, are injurious to health, and require most careful vigilance on the part of sanitary authorities.

The erection of factories and other workshops within the last quarter of a century threatens to add one more evil to those that already exist. The smoke nuisance, which is so loudly complained of in

Bombay, Calcutta, and many other places, is an evil of considerable magnitude, and special legislation is required to compel the owners of factories, who burn large quantities of fuel, to consume their own smoke.

Conclusion.—These remarks on the sanitary condition of Indian towns and villages would be incomplete without a short account of the present state of municipal and local boards finance, on which the whole question of sanitary reform obviously depends.

It is well known that municipal and local boards, with a due mixture of the popular and official elements, were established throughout this country by that liberal-minded statesman and administrator, the Marquis of Ripon. It is very often said that municipal institutions are an exotic growth in this country and will not flourish. This view, however, is not correct, and it involves a fallacy. Manu, the oldest of Hindu law-givers, has laid down what a township should be. A description of Manu's ideas in the matter is given in Elphinstone's History of India, from which it can be clearly perceived that municipalities or corporate bodies, self-elected, self-taxing, and self-governing, are of very ancient origin in India.

The people of India may be weak in their instincts when large interests are concerned, but they are keenly alive to the efficiency of their municipal arrangements. It is true that there is very great ignorance and apathy in the mass of the people, and there is, above all, the phenomenal poverty of the nation. These drawbacks are to be removed, and this must take time and require a large exercise of patience. The poverty of the people makes them impatient of municipal burdens, and no large work of reform can be undertaken without considerable expenditure. Formerly Government advanced loans from public funds or extended its guarantee to municipal loans. Government has shown considerable unwillingness of late years to follow this policy. The municipalities, left to themselves, cannot borrow money on cheap terms. People cannot bear additional taxation, and so, from year to year, large undertakings have to be put off, till the work of reform becomes, if possible, more urgent and more expensive. Moreover, in rural areas, local cesses were introduced professedly for improving communications and promoting education and effecting sanitary improvements. Out of every one anna charged as cess on the rupee levied as land revenue 8 pies were to be devoted to public works, including sanitary improvements, and 4 pies to education. Public works, especially road repairs, have gradually absorbed the 8 pies of cess revenue, and very little is spent or can be spent in improving the water-supply in small villages and towns. The local Legislature passed last year a Village Sanitation Bill, but as it failed to provide the means the law has remained a dead letter. Unless sufficient funds are provided no real progress is possible in this connexion. Boards and committees are powerless in such matters, unless funds are provided to strengthen their hands. When the local cess was introduced, the one anna charged on land revenue was also charged on Abkari revenue. The Local Government has, however, refused to recognize the claims of this cess on Abkari revenue, and has

appropriated all the increase to itself. If a due share of the 8 pies, appropriated for local boards, were set apart for sanitation, and if it were supplemented by a contribution out of the increased Abkari revenue, the sanitary boards would have a standing fund of their own; and they would be in a position to make slow but sure progress each year.

In large towns facilities must be provided by the Government lending its guarantee to municipal loans, and thus enabling municipalities to borrow large sums on reasonable terms. The present constitution of the boards, half elected and half nominated, is all that can be desired. But without adequate funds it is idle to expect that the boards would ever be able to effect substantial reforms. It is a subject worthy of the consideration of this Congress how far it can bring the pressure of public opinion to bear on the Indian Government to initiate a more liberal policy in this matter by taking steps to increase the local resources of sanitary village and taluka boards.

Notwithstanding the many difficulties in the path of local self-government the admitted success of the past few years promises for it a more useful future. Let the Government for some time longer continue to instruct and guide, and to refrain from undue interference or official pressure, and let it further liberally help where help is necessary, and the results will satisfy all who feel an interest in the prosperity of the people of India.

Legislative Action as applied to Village Sanitation in India.

BY

LIONEL ASHBURNER, C.S.I., formerly Member of Council in the Government of Bombay.

The Bombay Village Sanitation Act, I. of 1889, is a well-meant attempt to improve the sanitation of the rural districts; but it has failed, and has even intensified the evil it was intended to remove, owing to a want of practical knowledge of the difficulties to be overcome and to ignorance of the conditions of social life in an Indian agricultural community. The Act provides for the establishment in every town and village, or group of villages, of an unpaid sanitary board, who shall besides other matters:—1, provide pure drinking water; 2, clean the streets and open places; 3, remove all offensive noxious matters from the village; 4, prohibit nuisances and indecent or insanitary acts or omissions. For the purposes of this Act a town or village is defined to include an area of a quarter of a mile from such town or village.

A paid sanitary inspector is appointed to supervise the committees and boards and to see that they enforce the provisions of the Act. The committees and boards are authorised to levy a rate which shall not exceed one-half of the local fund cess, and they are empowered to punish offences

against the Act by a maximum fine of Rs. 10, or in default imprisonment in the village Chouri for 48 hours, but fines may also be levied by distraint and sale of the offender's personal property. The Act does not provide for the sustenance of the offenders during imprisonment. It is applicable to the whole of the Presidency of Bombay, except the towns of Bombay, Aden, Perim, and the Mehwassi villages of Kandesh. It is not apparent why the Mehwassi villages are exempt from the operation of the Act; probably some of the members of the Legislative Council had a faint suspicion that it was unsuited to the social conditions of an uncivilized community, but it is applied to the Dangs of Kandesh, and to many thousand villages in a far lower stage of civilization than the Mehwassi. There is nothing in the social condition of the latter to distinguish them from the great bulk of the agricultural villages throughout the Presidency.

The first thing that strikes the most superficial student of the Act is the utter inadequacy of the rate to be levied to effect any practical result; for example, take an ordinary district of 2,000 villages, with a local cess of two lacs of rupees, which is above the average. The Act authorises a levy of one lac. If this sum were thrown into a common purse with the local funds, and managed by the collector and local fund committee, it might perhaps be sufficient to provide pure drinking water for, say, 500 villages, and in the course of four years the whole district would be provided for; but when frittered away and distributed over 2,000 villages, each will receive only Rs. 50 per annum. It will be practically impossible to exercise any supervision over the expenditure of this small sum, and the whole amount will be absolutely wasted. Even this represents the amount available in the most favourable light. Perhaps 70 per cent. of the local fund cess is paid in small sums of less than Rs. 50 per village, so that the great majority of villages will have less than Rs. 25 per annum to provide a pure water-supply, to cleanse the streets and open places, to remove all noxious matters and to pay the Sanitary Inspector and his subordinates. The Act authorises the Committee to frame rules for the punishment of indecent nuisances and for the removal of noxious and offensive matters. These, to the uninitiated, appear to be very harmless and unobjectionable provisions of the law; but those who know the bitter hostilities and jealousies which divide the different factions in every village will at once understand what a dangerous implement of torture and oppression it places in the hands of the Committee.

Under pressure from jealous officials, most of the Committees have passed rules which require the removal of all refuse and manure to a distance of a quarter of a mile from the village, and have prohibited nuisances being committed in all public places.

In order to realise the full effect of these rules let us suppose that all house connexions with the main drains were closed in London, the domestic dustbins removed, and every householder required to carry the refuse of his house and stable daily one quarter of a mile into the Parks. It would, of course, be impossible to enforce such a measure, yet this is in effect what the Bombay Sanitation Act provides.

Manure is extremely valuable to an agricultural community. It is collected by the women with the greatest care. To require them to carry it a quarter of a mile, and to deposit it where it is liable to be stolen, is an almost incredible act of Utopian legislation.

As might have been anticipated, it has been found quite impossible to carry out this measure, but it must afford a rich harvest of extortion and blackmail to the Committee. The effect of the prohibition of nuisances in public places has been still more disastrous. In many places public cloacas have been provided, but in the absence of water and of Bungys to keep them clean they become Augean stables of filth, which poison the air for several hundred yards; no respectable family will use them, and the result has been that in every house a cesspool, locally called a kalkoa, has been dug in the house or back yard, often within a few feet of the well which supplies the family with drinking water. The consequences may be easily imagined. The cesspools are *never* cleaned, but when *quite* full a quantity of salt is thrown in which attracts moisture from the atmosphere, and thus liquefies the contents, which are then absorbed into the soil. This practice will probably account for the water of wells in large towns becoming salt, and for the prevalence of typhoid fever in cantonments, where there are large bodies of native troops with followers who have been forced to resort to this pernicious system by injudicious legislation. The impracticable provisions of the Act are so obvious that it is hardly necessary to accumulate evidence on this point, but it must be remembered that the Bungy caste, who alone will dispose of human excreta, is a very small one. They are attracted to the large towns, where they can demand a rate of pay that is the envy of graduates of the University. There are whole districts in which not a single member of this caste is to be found, and in others there may be one or two families who are employed by European officers.

When this fact is fully realised it must be evident that the only practical system of conservancy in modern India is one which provides for the disposal of excreta, by the people themselves, in places where it can be exposed to the sanitary action of the sun and dry air or at once deodorized by a few handfuls of dry earth. For this purpose the best and only plan is to secure fields and open spaces conveniently situated, and to dig trenches into which a small quantity of earth may be thrown daily by the people who use them or by the village *mâhârs*.

The fields are enriched by the manure thus deposited in them, and they should be changed periodically and let for cultivation when not in actual use. This system was in operation over the greater part of the Bombay Presidency, and its universal adoption was only prevented by the high value of land in the neighbourhood of large towns and the limited funds available. It is to be regretted that the Legislature was not contented to let well alone, or at most to legalise the system, and to enable the collectors to take up land on payment of reasonable compensation in consideration of the fertilizing process it has undergone.

Very undue importance appears to have been given to the question of rural sanitation compared to the far more pernicious spread of venereal

disease which has resulted since the suspension by Parliament of the Contagious Diseases Act. Sanitary reformers might with great advantage direct their attention and influence to this vital question, which is not only depriving the nation of the services of one-fourth of its soldiers and sailors, but is undermining the health and vitality of the rising generation, and thus providing the first step towards national decay.

DISCUSSION.

Mr. Ardaseer D. Cooper, M.R.C.S., D.P.H., made the following recommendations:—

I. That the Indian municipalities be empowered to close contaminated wells, tanks, cisterns, &c.—II. That certain wells be set apart for drinking purposes, and others for washing and cleaning purposes. The same remarks apply to river ghauts (steps leading to water mark); that is, that the up-ghauts be reserved for drinking purposes and down-ghauts for cleaning and washing purposes.—III. That river water should be largely used, as it is generally purer than well water.—IV. Conservancy of small towns may be left safely to nature and to dogs, vultures, fowls, &c.—V. Health officers must be appointed for every district.—VI. Salt must be made cheaper and more easily accessible.—VII. Abkari system must be revised.

Mr. M. M. Bhownaggree, C.I.E. (Delegate from the Bhavnagar State), said:—I have to lay before this meeting two papers, one by Dr. Burjorjee Byramjee, head of the medical department of the Bhavnagar State, and the other by Mr. J. N. Unvala, Principal of the Samaldas College, in the same territory. Dr. Burjorjee is a man of long experience and high standing in his profession, and possesses a perfect mastery of the subject on which he has written. The towns and villages in other parts of the peninsula of Kathiawar are, in their sanitary conditions and in the modes of life of their inhabitants, so similar to one another that Dr. Burjorjee's paper, although treating of Bhavnagar particularly, serves a like purpose with regard to the whole province of Kathiawar generally. The other paper, which I shall presently read to you, is written from an educationist's point of view. The writer, Mr. J. N. Unvala, is a distinguished graduate of the University of Bombay, a man of wide culture, a linguist, and one who has with keen observation noted the requirements of his pupils, and has successfully tried, during a career of more than a quarter of a century, to supply them. He has visited Europe, and among his multifarious studies included a knowledge of sanitary laws and the elementary principles of public health. You will see that in his brief paper, or, rather, notes, he has insisted on utilizing popular agencies for the dissemination of the laws of health among the people. We have heard much this afternoon regarding the so-called duty of Government to do all that which, or much of which, I think the people themselves ought to do, and therefore I call your attention particularly to this feature of Mr. Unvala's notes.

Notes on the Topography and Sanitation of Bhavnagar,

Including a Description of the Sanitary Condition of Towns and Villages in Kathiawar in Western India.

BY

BURJORJEE BYRAMJEE, Member of the State Council, and Head of the Medical Department of Bhavnagar; L.M. and Fellow of the University of Bombay.

The Province of Kathiawar, in which the State of Bhavnagar is situate, is a hilly peninsula in the north-west of the Bombay Presidency bounded on the north by the Gulf and Run (or Desert) of Cutch, on the west and south by the Arabian Sea, and on the east by the Gulf of Cambay and the northern portion of the Ahmedabad Zilla. It lies between 20° 40′ and 23° 25′ north latitude, and 60° 5′ and 72° 20′ east longitude. It measures about 200 miles from east to west, and 170 miles from north to south, covering an area of about 23,500 square miles, with a population of more than 2,500,000 souls (*vide* Appendix A.).

The Province was known to the ancient Greeks by the name of Saurashtrà. The name may be said to have been derived from *Su*, meaning good, and *rashtra*, meaning country, good country; or *Surya*, sun, and *rashtra*, region, thus meaning land of the sun. The Mahomedans called it Sorath, which is the Prakrit from the above-mentioned name of Saurashtrà.

Kathiawar is so-called from the people named Kathis inhabiting its central portion.

Geologists think it was originally an island, and that its present peninsular form is attributable to volcanic action. All the tract of land on the north-east is much below the general level, and destitute of trees.

The soil varies in different parts. A tract called Bhàl, on the eastern side, is alluvial and fertile, yielding abundant crops of grain and wheat. Jhàlàwad, on the northern side, produces large quantities of cotton. The chief products of the other parts are bàjaree, juvàri, grain, wheat, sugar-cane, and different varieties of pulse.

The Province is traversed towards the north-east by a portion of the Bombay, Baroda, and Central India Railway, and is intersected by the various branches of the Bhavnagar-Gondal-Junagad-Porebandar Railway and the Morbi State Railway.

The chief towns are Bhàvnagar, Junàghar, Navànagar, Dharàngadrà, and Ràjkote; with Dwarkà on the west; and Paḷitana near the

south-east portion. At the last two places thousands of Hindoo pilgrims from all parts of India congregate on occasions of grand religious festivals.

The State of Bhàvnagar is situate at the head and on the west side of the Gulf of Cambay in this peninsula. It lies between 21° 18′ and 22° 18′ north latitude, and 71° 15′ and 72° 18′ east longitude. Its area is about 2,784 square miles, with a population of 428,500 souls. On the south and east it is bounded by the Arabian Sea and the Gulf of Cambay.

The city of Bhavnagar was founded in 1723 by Thakore Bhàvsingjee, who, as well as his son Akheràjjee, and his grandson Wakhatsingjee, took great pains to improve the trade of the country, and to destroy the pirates who infested the neighbouring seas, which led to the establishment of a very intimate connexion between the chiefs of Bhàvnagar and the British Government in the latter half of the 18th century. The boundaries of the Bhàvnagar State were from time to time, as opportunities offered, enlarged by these chiefs by acquisitions made from the surrounding villages previous to the now historical settlement of Kathiawar by Colonel Walker in 1807–8.

The State is divided into 10 Màhàls or Parganas, that is, districts.

The aspect of the country differs widely in different places, being in some parts, such as the Bhàl, a mere salt flat; in Lilia, a rich plain of black soil; while parts of the hilly Sihor range, and the hills in the Kundlà and other districts, show a country almost mountainous in its configuration. The hills are all volcanic, and consist of trap and basalt piercing through, and in places elevating, a coarse sandy limestone. The northern districts are mostly bare of trees, but the Sihor hills are covered with a dense scrub jungle, and the southern Parganàs are better wooded, though infinitely inferior in this respect to Gujràt proper. Except in the Bhàl, where it is highly impregnated with saline matter, the soil is almost everywhere black, and is divided into two kinds, viz., garden land and dry crop land.

The climate of the Bhàvnagar districts, especially of the southern coast, is pleasant, and the heat in the hottest portion of the year is not comparable in intensity with that of Gujràt proper. The thermometric readings at Bhàvnagar itself show a mean minimum of 53° in the month of January, and a maximum of 108° in the month of May. The average rainfall in Bhàvnagar, calculated from recorded observations for the last 10 years, is 26·35 inches.

The census returns of 1891 show in that year in the whole State 130,653 houses, or on an average nearly 47 to the square mile, and 3·5 souls to a house. Appendix A. shows the number of houses, population, &c. in each màhàl or district.

The State is on the whole amply supplied with well-water, which in the southern districts is found very near the surface. Except the Gagá-talao there are no other reservoirs of any great size in the State, but most of the villages have a small tank or pond in which, however, the water rarely lasts after the beginning of the hot weather in April.

The chief articles of food are rice, tûr or moony dàl, bàjari, wheat, and vegetables. The poorer classes use til-oil on the bread, and in khichdee, and vegetables. And the well-to-do people use a large quantity of ghee (clarified butter) instead of oil. Sugar is used in large quantity either with milk, tea, or in the form of sweetmeats. A hot infusion of tea, or rather a decoction of tea leaves with spices, is very commonly used by the upper and middle classes as an afternoon beverage. Betel-nut chewing with pàn leaf follows every meal or drink. Fruit of all sorts is considered to be unwholesome, and few people use it regularly as an article of daily food. Mangos are, however, consumed in large quantities and in different forms. The habit of opium-eating, which was a few years ago the curse of Kathiawar, is slowly decreasing. Indulgence in intoxicating drinks is not so common here as in some parts of Gujràt.

In order to realise the conditions which give rise to and propagate many forms of illness, and produce periodical outbreaks of fevers and epidemic diseases, we must picture to ourselves the original construction of the various towns or cities in this and other States of the Province; they are built within a very narrow compass, surrounded by high walls; the majority of the houses are of mud; they are low, dark, and badly ventilated, having no other aperture but the door for the passage of air. Men and cattle are not infrequently packed together inside these houses. The atmosphere in the rooms is consequently foul and oppressive, and sunlight rarely enters there. The streets are narrow, winding, and full of filth. They are not regularly cleaned. The house-refuse, with every sort of rubbish and decaying vegetable matter, is allowed to accumulate in the compound, or back yard, and by the sides and front of the houses.

Very few houses are provided with privies or water-closets, and people generally use open spaces near their houses for natural purposes. Drinking water, of which there is generally a scarcity, and which is drawn from wells or tanks, or sometimes from rivulets, is contaminated by people bathing near the margin of the reservoirs, washing dirty clothes, and cleaning their cooking-pots, and using the surrounding ground for natural purposes. There are no regular slaughter-houses provided, and animals are slaughtered almost anywhere; there are no restrictions placed on the sale of unwholesome food, and on the carrying on of offensive trades and occupations; no places set apart for burning and burial purposes.

It would be well to pause here to remark that this general picture of the construction and condition of a town in Kathiwar, although still unfortunately true of many towns in the inferior and backward States of the Province, is not to-day applicable to the larger towns of the prominent States. The better-administered States have in recent years introduced into their townships and villages various forms of municipality, and the tendency among them is to better the condition of houses, streets, and open spaces. Speaking particularly with regard to Bhàvnagar, which, in this, as in many other matters of administration, has been trying for years past to imitate the system

introduced into British provinces, it may be confidently stated that the conservancy and municipal reform of its capital and chief towns is satisfactory and progressing. H.H. the Mahraja Takhtsingjee, G.C.S.I., its enlightened ruler, is always anxious and ready to introduce in his territory all practicable municipal improvement, and backed as he is in his efforts in this direction by his able Public Works Councillor, Mr. R. Proctor-Sims, C.E., and other co-adjutors, they have been prolific of results of which the general appearance of the chief towns, and the improved health statistics (*vide* Appendix B.), are manifest proofs.

To resume the description of the condition of an ordinary town in Kathiwar—the mass of the people is ignorant of the commonest laws of health. They cannot be made to believe that infringement of sanitary laws is punished by nature with many pestilences and serious ailments. Small-pox, measles, cholera, and other epidemics are complacently regarded by them as visitations of their various enraged "gods" and deities, and as being beyond all human control. They make offerings, and give feasts, and mumble prayers to appease the wrath of these unseen beings, but continue to scatter the excreta of cholera and other infectious patients in streets, near a well or water reservoir, even at the very threshold of their houses. The corpses of persons dying during epidemic ravages are not at once burned or buried, and even the clothes of the patients are appropriated by their relatives. Much less is the process of disinfection known to them, nor is any attempt made to isolate infectious cases. Very often patients are left without any treatment, the relatives being content to invoke the aid of the "gods," instead of seeking medical aid, even when the latter is within easy reach.

This, as already remarked, is a picture of what used to be the case in many towns of Kathiwar. Wherever a knowledge of the rules and science of public health has been introduced this serious state of things continues no longer. In many States measures are now taken to enforce sanitary laws. Vaccination has been freely introduced, removal of filth from towns and rural districts is systematically effected, municipalities are established in the capital and in all the chief towns of the Parganàs. Dispensaries are opened in all these places, and the questions of a sufficient supply of pure water, of isolation and treatment of poor and helpless patients suffering from contagious diseases, of precautions against the adulteration of food and drink, and of preventing the pursuit of offensive trades and occupations are considered, and the necessary measures adopted.

The city of Bhâvnagar when first constructed was enclosed within high stone and chunam walls, measuring 2,250 feet from north to south, and 1,500 feet east to west. The dimensions of the city have since increased to 8,400 feet north to south, and 5,600 feet east to west. The streets are now widened, and there is a network of good metalled roads in and around the town. The roads are extending on all sides, as well as large, elegant, and well-ventilated buildings. The streets and lanes are regularly cleaned, watered, and lighted every day. Dustbins are

placed in different localities to receive house refuse and other filth, and are emptied daily, the sweepings being taken to depôts established for the purpose, and a portion converted into manure.

All water for drinking was formerly drawn from wells, and the water-supply of Bhàvnagar was then very scanty, especially in the hot season. But the Gagà-talao, which is a fine artificial lake about five miles in circumference formed by bunding across the bed of the Gadechi river, has supplied the deficiency, and the new project of the Victoria Jubilee waterworks has relieved the anxiety regarding a water-drought, and conferred a much-needed boon on the poor by providing hydrants.

Separate enclosures for bathing and washing purposes, both for the male and female sections of the population, are also provided in many parts of the town.

The Markets are two in number. One of these, the Percival market—so called after Mr. E. H. Percival, of the Bombay Civil Service, who was joint-administrator of the State during the minority of the present ruler, and who in that capacity was greatly beloved by the people—is a large and elegant building, exclusively used as a vegetable market. The other, which is a meat and fish market, has a suitable slaughter-house attached to it. Both are under the direct supervision of the Municipality. The sale of unwholesome meat or provisions is prevented, and cleanliness is enforced in these markets by the town municipality.

Fourteen substantially-built latrines are erected in different localities for the use of the public. The latrines are built in such a way that the excreta are collected automatically in barrel-shaped cisterns. About 50 cartloads are daily collected and conveyed to the night-soil depôt, which is two miles distant from the limits of the town. At this depôt beds are formed to receive the filth, which is covered over with a thin layer of ashes with which it is well mixed up and then exposed to the sun for a day or two. It is then again stirred and allowed to remain till it is thoroughly dry. During the monsoon or rainy season, which lasts from July to October, poudrette is prepared under roofs erected for the purpose. It is then stored in heaps for sale as manure. At first the cultivators objected to use the poudrette thus prepared as manure, but it is now much valued by them, and the demand is increasing.

The public latrines are intended for the use of the poor. The houses of the better classes have privies attached to them.

People pursuing offensive trades, such as brick-burners, fellmongers, tanners, &c., are all brought under the control of the municipality. They are allowed to pursue their occupations only at a distance from the town, suitable accommodation being provided by the State for them.

Old burial and cremation grounds which are in the vicinity of the city are now closed, and new ones opened at convenient distances.

There are beautiful public pleasure grounds and gardens in and around the town, such as the Jasonàth, Pànvàdi, Vàghàwàdi, and the Peile Gardens.

The last-mentioned gardens are, like the Percival Market and Percival Fountain, named after an eminent member of the Civil Service of Bombay, now Sir J. B. Peile, K.C.S.I., of the India Council, to commemorate his interest in the State and friendship with the Chief. All these gardens and squares, to which two more have lately been added, namely, the Victoria Jubilee Park and the Albert Victor Square, are devoted to the use of the public, who freely resort to them. They are health-imparting centres to a populace whose small and confined houses make it essential in a greater degree than can be realised by inhabitants of towns and cities in Europe, that they should have, for the preservation of health and bodily energy, open spaces and gardens to resort to during a large part of day and even of the night.

Appendix A.

Statistical Table of Bhavnagar.

Names of the Paraganas or Districts.	Number of Villages.	Number of Houses.	Population.	Area.
				Acres.
Daskroi, including Bhal and Bhavnagar City.	73	26,126	91,482	307,576
Mahuva, including Rajula - -	181	26,091	102,893	389,147
Kundla - - - - -	103	21,472	80,145	352,169
Umrala - - - - -	54	10,956	40,623	137,318
Lilia - - - - -	36	5,746	26,774	94,928
Botad - - - -	41	10,049	28,073	146,754
Gadhada - - - -	39	8,063	25,458	121,658
Sihor - - - -	54	10,960	34,695	126,198
Talaja - - - -	81	9,390	33,652	144,759
Total - - -	662	130,653	463,795	1,821,512

Appendix B.

The following extract is taken from the Report of the Medical Department of the Bhavnagar State for 1890–91:—

Dispensaries.—Patients.—Diseases.

The number of dispensaries throughout the State has remained the same, but the number of patients treated as against last year shows a decrease of 11,712, which points to the past year having been healthy. The average attendance of the patients of all the dispensaries was 1,632 per diem, a decrease of 136 under last year. Fever, as usual, holds sway; itch, ulcers, and abscesses coming next in order of importance. Cholera of a virulent type appeared in Mahuwa, but prompt sanitary arrangements instituted by the Municipality soon effected an improvement. There were 3,068 operations, including one case of cataract of the eye,

35 cases entropia, 8 cases of craniotomy, 8 cases of lithotomy. The following statement affords further details :—

No.	Names of Dispensaries.	Total Number treated.		Deaths, as reported.		Average Daily Attendance.		Expenditure of Medicine, &c.	Income.
		1889-90.	1890-91.	1889-90.	1890-91.	1889-90.	1890-91.		
	Bhavnagar—							Rs. a. p.	Rs. a. p.
1	Sir Jasvatsingji Dispensary.	25,409	26,035	67	53	434·7	457·1	22,611 12 1	86 12 9
2	Juvansingji Dispensary.	26,992	20,142	64	20	422·1	312·7	4,432 14 2	9 4 3
3	Jail Dispensary -	1,948	1,560	17	5	60·2	47·1	3,938 3 1	—
4	Mahuwa „ -	16,868	15,909	51	65	298·6	295·6	3,485 12 4	23 9 3
5	Sihor „ -	8,880	6,660	3	3	112·8	83·3	1,899 13 3	12 14 6
6	Kundla „ -	9,011	11,190	57	70	131·1	173·1	3,598 13 5	—
7	Botad „ -	3,167	2,141	18	2	43·2	27·2	1,255 5 4	7 6 3
8	Talaja „ -	6,129	4,011	12	3	51·3	41·0	1,349 1 4	5 8 4
9	Umrala „ -	4,411	3,142	6	3	41·0	40·9	1,368 11 9	2 10 8
10	Gadhada „ -	3,329	3,502	4	11	33·3	37·8	1,169 0 0	2 6 4
11	Lilia „ -	4,338	3,433	1	10	44·8	36·4	1,411 4 8	12 11 7
12	Rajula „ -	4,505	5,234	5	7	55·3	58·6	1,179 3 1	4 4 3
13	Jesar „ -	783	1,604	1	3	40·3	20·6	1,830 3 1	—
	Grand Total -	115,770	104,658	306	255	1,768·7	1,632·0	49,530 1 7	167 8 2

REMARKS.

Total Number of Patients Treated.—The total number of patients treated in the thirteen dispensaries of Bhavnagar State (including the small Jail Dispensary at Bhavnagar) during the year 1890–91 was 104,658. Of these, 104,058 were out-patients, and 600 in-patients. Comparing these numbers with those of the last year, there is a fall in the attendance by 11,112 this year on account of the malarial fever being less prevalent during this year than its predecessor.

Average Daily Attendance.—The daily average attendance was 1,632, being 136·7 less than that of the last year.

Prevailing Diseases.—Malarious fever was less prevalent this year than the last, and thus there was a fall in the fever cases by 5,166. However, among all the diseases, malarious fever presents as usual the largest number of cases, the percentage of total treated being 28·8. Next to fever in prevalence were itch and boils and abscesses, their percentage being 10·9; and dyspepsia 9·2 per cent. Besides these, the other most common diseases were eye affections, 5·8 per cent.; bronchitis and lung affections, 5·6 per cent.; ear diseases, 4 per cent.; rheumatism, 3·9 per cent.; diarrhœa, 3·4 per cent.; intestinal worms, 2·9 per cent.; wounds and injuries, 2·8 per cent.; and diseases of the nervous system, 2·2 per cent.

Cholera.—The cases have been registered in Bhavnagar and the other dispensaries as shown below :—

Names of Dispensaries.	No. of Patients treated in 1890–91.	Result.		The Months in which the Disease was prevalent.
		Cured.	Died.	
Bhavnagar Sir Jas. Dispensary.	4	2	2	August, 4.
Mahuwa Dispensary -	101	61	40	In May 3; July, 64; August, 34.
Sihor " -	3	3	—	—
Kundla " -	29	10	19	April, 12; May, 15; June, 2.
Umrala " -	1	—	1	April.
Gadhada " -	10	6	4	May, 7; June, 3.
Lilia " -	5	3	2	April, 3; July, 2.
Jesar " -	4	3	1	July.
Total - -	157	88	69	

The mortality from this disease has been 43·9 per cent. The dire disease was very prevalent in Mahuwa during the months of July and August, and the reasons to which it has been ascribed were atmospheric changes following heavy rain-falls and dyspepsia from partaking of indigestible articles of food. As for Kundla and Gadhada, the disease appeared to have been brought by such patients coming there from Amreli, and in the rest of the towns the cases have been sporadic and ascribed to dyspepsia only.

Measles.—The disease has been known to some extent among children in Bhavnagar in the months of June 1890, and January, February, and March 1891, and it is not known to have done much mischief. Only one case had been registered in June at the Sir Jasvatsingji Dispensary. At Kundla and Talaja it has been known to prevail in the months of July and August 1890 and March 1891, but no case has been registered in the dispensary records.

Small-pox.—Sporadic cases have been known to occur in Bhavnagar during the months of May and June 1890, and in Kundla, Talaja, and Gadhada during the months of January, February, and March 1891, but no case was admitted into any of the dispensaries. The disease had been ordinarily mild throughout.

Rain-fall.—The following table shows the quantity of rain-fall registered in Bhavnagar and the other dispensary towns in the districts :—

Town.	Rainfall in 1890–91.	Average Rainfall for the last five years.
	Inches.	Inches.
Bhavnagar - - - - -	22·81	22·56
Mahuwa - - - -	30·55	24·8
Sihor - - - - -	16·28	23·18
Kundla - - - - -	19·32	24·67
Botad - - - - -	8·40	22·98*
Talaja - - - -	25·51	29·96
Umrala - - -	20·98	19·89
Gadhara - - - - -	16·10	21·83
Lilia - - - - -	10·8	23·24
Rajula - - - - -	22·91	24·39
Jesar† - - - - -	21·7	—

* Much below average quantity. † Opened in January 1890.

Expenditure.—The sum of Rs. 22,611-12-1 has been put down in the preceding abstract as the total expenditure of the Sir J. Dispensary; it, however, includes Rs. 9,957-2-0, being the expenditure of the office of the Superintendent of Medical Department, as well as Rs. 390 being the amount of bonuses granted to the servants of the department on the occasion of marriage and death ceremonies among their families.

Income.—The Sir Jasvatsingji Dispensary at Bhavnagar is shown to have made an income of Rs. 86-12-9 during the year. It consists of receipts from sales by public auction of useless empty bottles and tins and worn-out clothes, &c., as well as of the articles belonging to the in-patients who die in the wards and have no persons to claim them. It also includes Rs. 32-8-6, consisting of receipts from articles belonging to the stores similarly disposed of.

His Highness has continued during the year the usual bounty from His Highness' Private Charity Fund, which has been used to supply very liberally clothing, food, and passage-money to patients coming from distant places.

How can the Masses in India be made to Comprehend the Elementary Principles of Sanitary Science?

BY

Professor JAMSETJEE N. UNVALA, M.A. and Fellow of the Bombay University, Principal of the Samaldas College, Bhavnagar.

The first question that presents itself for consideration is, "What has hitherto been done?" Practically nothing. Bare orders from Government officials, which the people are apt to find very unpalatable. They have scarcely any effect on the masses, who very often, in their ignorance, look upon them as precursors to additional taxation. Educating the public mind gradually is, therefore, absolutely necessary.

A Sanitary Primer, published by Dr. Cunningham, of Calcutta, under orders from Government, was for some years a standard text-book in the lower forms of Government and aided high schools. It was a good book in its way; but it proved uninteresting. It is now out of print, and discontinued; one does not know why. I think Government ought to appoint a committee of practical educationists, together with a few medical experts, to write two elementary books in simple English for High School standards, one more advanced than the other.

A knowledge of sanitary science should be made compulsory for the school final examination, and optional for the matriculation. Text-books for these, published in England, may be prescribed.

The two Government text-books must simply give the students an elementary idea of the composition or constitution of the air, water, and liquid and solid foods; a description of the lungs, the heart, the stomach, the skin, &c., &c.; of common diseases springing from an infringement of sanitary laws; a knowledge of their origin, symptoms, and prevention;

of filtration of water; of drains; latrines; adulteration of food; the sick-room; and finally treat of precautions during epidemics.

Practical illustrations of what is read in the books, as far as the resources of the schools admit, would prove highly instructive and interesting. For instance, let the teacher get the lungs, the heart, the brains of a goat, and show them to his pupils. My pupils—in school as well as college—are most of them Hindus. I inflate the lungs by blowing into the wind-pipe, and thus give them an idea of respiration. For the general structure of the eye I get a goat's eye, cut it, and show them the crystalline lens and other interesting details. Sheep's eyes are always very interesting. My boys are highly delighted when I show them these, and also other chemical and physical experiments. All along one must respect their religious feelings, and not touch them when handling these subjects.

These text-books should also be translated into the vernacular languages, or adaptations of them should be made for the vernacular schools, for both boys and girls.

Charts or wall-maps should be specially constructed to illustrate most of the facts treated in the text-books. These charts should include coloured representations of flies, mosquitoes, lice, bugs, water animalcules, and other vermin—all magnified.

Now, as to how to touch and educate the people at large.

Public bodies, religious, semi-religious, political and so-called patriotic—may be asked by Government, or take upon themselves, to organize a system of mission-work for lectures on sanitary science. *Exempli gratiâ*:—The *Arya Samâj*, which has already some 800 branches in India, was the first to organize the Gorakshaka (or protection of cows) movement; and missionaries, called *Upâdeshakas*, all over India, are working away most vigorously in that behalf. I, for one, am sure that the *Arya Samâj* will undertake this sanitary lecture work willingly. It would be in no way derogatory to Government to ask such public bodies to co-operate with them. Government lose nothing, and the societies would feel complimented by being so asked. Voluntary lecturers might come forward too. This plan would cost Government nothing. Charts, wall-maps, and scientific apparatus belonging to schools may be lent to such missionaries to illustrate their lectures.

One important adjunct to this mission work would be the magic lantern. The magic lantern mission work in England has been most beneficial. The Indian Government can ask the magic lantern makers in England to construct cheap, but durable, kerosene-oil magic lanterns, with, say, about a hundred slides, illustrative of subjects appertaining to sanitary science. According to my estimate, a good lantern, with the 100 slides, would cost Rs. 150 to Rs. 200. The town and city municipalities may be asked to buy them, the expense being a mere trifle. Government has been supplying scientific apparatus, including a magic lantern, to the high schools in this Presidency. So that, at any rate, they could be easily supplied with the sanitary slides. Thus the municipalities and the schools can lend their apparatus to the sanitary mission lecturers mentioned above.

Mere words can have no effect. An appeal to the eye has a more lasting effect than an appeal to the ear, as was well said by the Latin poet Horace:—

> Segnius animos irritant demissa per aurem,
> Quam quæ sunt oculis subjecta fidelibus, et quæ
> Ipse sibi tradit spectator.

Some of the Practical Measures needed for the Development of State Hygiene in India.

BY

DINSHAH ARDESHIR, Baroda.

If I may venture to classify roughly the questions which will engage the attention of the Congress, the classification will be something as follows:—(*a.*) Corporate sanitation; (*b.*) International sanitation; (*c.*) Physical sanitation; (*d.*) Industrial sanitation; (*e.*) Mental sanitation.

(*a.*) Corporate sanitation refers to every individual town and village sanitation of a country.

(*b.*) International sanitation especially concerns an understanding between different nations as to protection of life against importable diseases and epidemics arising from various causes.

(*c.*) Physical sanitation relates to the conservation of sanitation by means of pharmacy, surgery, &c.

(*d.*) Industrial sanitation pertains to the regulations necessary for factory labour and organised skill of all descriptions.

(*e.*) Mental sanitation connects itself with all systems of teaching and education imparted through schools, universities, &c.

I would here respectfully mention some of the fundamental measures requiring the cognizance of the Congress.

(1.) A technical board of examiners should be instituted in each Presidency, whose certificate should alone warrant municipal boards to employ sanitary officials of any importance. The present entire absence of such a controlling authority in India is most lamentable.

(2.) It should be made compulsory on every municipality to provide funds for deputing a certain number of willing students every year to apprentice themselves to some of the best municipal corporations in England, France, and Germany, such qualified persons being deemed eligible for the higher grades of municipal inspectorships or secretaryships. Facilities should also be provided for students desirous of passing higher examinations, which, I believe, are now regularly held by a competent board in England, a sufficient number of medical and engineering students being sent to England every year, who may, on return, be offered appointments, to a certain extent, as health officers and sanitary engineers.

(3.) It should be compulsory on the municipalities and local funds' boards of each Presidency to provide funds to the parent Governments for securing the services of sanitary engineers and health officers of hygienic and medical proficiency, who would form leading authorities on the boards of examination and become responsible advisers of both Government and the municipal authorities. The board should also consist of local men of practical experience well known as successful municipal councillors of some years' standing.

(4.) The sanitary commissioners and engineers with the various Governments may well be afforded facilities to visit Europe and America, with a view to study divers hygienic measures on the spot, so that a better competency may be acquired by them to properly advise sanitary authorities on the merits or demerits of particular systems as actually worked in those countries.

(5.) An independent committee should be appointed by the Government of India, whose chief function would be to investigate the larger sanitary measures as carried out in India, with a view to prepare a compilation in which the evils of faulty works and of such as have been executed at a ruinous cost and by non-efficient or corrupt agencies should be delineated, while such measures as can be safely laid down for adoption, on the ground of actual adaptability and economy, should be explained.

(6.) The Government of India should establish at least one weekly Hygienic Journal of authority, edited by principal sanitary officials, in which the municipal authorities should be allowed to explain their doings, and the managers of the journal may help them by pointing out either the defects or excellences of the municipal procedures and operations. This journal can be made a paying one, for hundreds of municipalities are likely to subscribe to it and use it as a professional medium for advertisements to obtain information about cheap and legitimate articles, and to prevent the vast misappropriations of funds now taking place in the absence of such a medium, inviting all manner of professional dealers in Europe, America, and the East to offer the required goods and machinery, or to undertake the erection of works on competitive terms, which can be better relied upon than private systems of personal jobbery. This journal will, moreover, pay its professional conductors most liberally, who will, of course, form a part of the Government Board, as above suggested. A Sanitary Moniteur of this sort is essential to bring about an harmonious, co-operative, and emulative spirit throughout the country, where at present the municipal actions, as carried on in different places, are fitful and inconsistent.*

* It must be made a rule that no important municipal or sanitary scheme should be adopted in India unless a concise report of the same and the plans, estimates, &c., bearing on it, is published in this journal at least three months before the final adoption. A great and instructive light can thus be thrown on projects, which is now lamentably wanting. I am sure two or three years' successful working of the journal will make the necessity of each Presidency having its own Hygienic Moniteur self-evident, and a most important desideratum of each province may thus be fulfilled in due time.

I have not the least desire to detract from the high consideration so justly due to the chief sanitary officers with the Indian Governments. The intelligence and industry bestowed by them on their work have often been very deservedly applauded. But their efforts will not go a very great way unless they are supplemented by measures of the character above noted. It is the barest outline of work which they have at all been able to effect, though in a manner highly creditable to them. The time is now come to strengthen and develope the scope of their work, and to give it that great finish and impetus without which the administration of sanitation in India will not attain the excellence and perfection marked in other branches of the Indian British rule.

The concession of an automatic system of municipal government which has been freely made in India, must, however, demand such efficient safeguards as those above dealt upon. If hygienic works are mismanaged, or not properly attended to, the source of such failures is mostly due to the absence of reliable scientific methods and of an intimate knowledge of native life in its multifarious aspects, which no traditions of any popular corporation in India, or any superficial grasp of the vital problems, such as we have been accustomed to for years, can possibly supply.

The measures of development here suggested only form a portion of the constitution which the various Governments may be induced to lay down for the better operation of practical hygiene in India. A fixed plan of operations must be laid down for every distinctive part of a Presidency, while the character of the sanitary works, and the methods by which they should be carried out, should be indicated with some tolerable certainty.

The question as to how regularly to proceed with a material renovation of old Indian towns is one of the burning questions of the day not yet fully or authoritatively dealt with.

The sewerage and rain-water drainage questions in India, as now understood, have not been definitely settled in many of their serious aspects. Nor has it been accurately decided which is the best style of house conservancy that would fit in with the conditions and circumstances of the people at the same time that all the good expected of it may be achieved. The passionate or half ignorant adherence of ill-informed executives and debating authorities, often forming opposite camps, does not furnish any guarantee for effectually or economically executing such hygienic works as would not be likely to inspire contempt or condemnation in the immediate future, and would survive for many successive generations the hasty and bungled efforts of busybodies which often impose ruinous burdens upon people hoodwinked into acquiescence.

There should also be a Sanitary Member of Council at the India Office.

I would venture to suggest that, before the Congress disperses, the desirability of imparting some permanent feature to its Oriental Section may be considered.

Sanitation in Ceylon.

BY

SOLOMON FERNANDO, M.B., C.M., Aberdeen, Delegate from the Government of Ceylon and from the Ceylon Medical College.

The Island of Ceylon is situated at the southernmost extremity of India, being separated from it only by the narrow Straits of Paumben. It has an area of 25,000 square miles, and a population of 3,000,000. The mean temperature of Colombo, the capital of the island, situated on the sea-board, is as high as 80·9°, but the heat is largely tempered by ocean breezes and the humidity of the atmosphere, while the mean temperature of Newera Eliya, our sanatorium, is 57·6°, going down in January, the coldest month, to 56·5°. The average annual rainfall of Colombo is 88·84 inches, more or less evenly distributed throughout the year. We have a birth-rate of 27·8, and a death-rate of 23 per 1,000.

The diseases most prevalent in the country are malarious fevers, Parangi disease, bowel complaints, and chest affections. Much has been done of late years to diminish the prevalence of malarious fever, by extension of cultivation and drainage of land. Formerly during heavy rainy seasons, rivers overflowed their banks, and on the subsidence of the inundation there were severe outbreaks of fever; but of late years deep channels have been cut, favouring the flow of water into tanks or into the sea. These outlets have, in a great measure, saved parts of the country which used formerly to be flooded, thereby diminishing the outbreaks of fever. The opening up of the country and the extension of cultivation in places in the island formerly known as haunts of fever have also been effectual means of diminishing the prevalence and severity of malarious fever, and of improving the health of the country. Anuradhapura, Kurnegalle, Putlam, Hambantota, and some other places have, in a great measure, lost their former bad reputation. Negombo, still a feverish place, is gradually undergoing improvement by the drainage and gradual filling-up of marshes and low-lying places in its neighbourhood.

The attention of Government has been directed for some years past to the prevalence in some parts of the country of a general disease with a skin eruption, and sometimes cachexia, termed *Parangi*, allied, if not identical, with the *Yaws* of other countries. The disease has been known to the natives of the country for a considerable period, but its prevalence forced itself on the attention of Government only a little more than 20 years ago. The disease is most common in the interior and arid parts of the island, and undoubtedly proceeds from bad and insufficient food, bad water, and probably malaria. Prompt measures have been taken by Government to afford relief to the sufferers and to abate the disease. Much good is anticipated from the irrigation works lately constructed, which will ensure to the inhabitants of the places where this disease is most prevalent, an abundant supply of pure water for drinking and other

domestic purposes, while the facilities for cultivation will secure an increased supply of wholesome food. In the meantime, in most of the rural hospitals there are special wards for the treatment of patients suffering from Parangi. In some places special Parangi hospitals have been opened during the last two or three years. The treatment, now well established, is simple and effective, and the disease is easily cured.

Colombo has had its Leper Asylum since 1708. It was founded by a Dutch lady, herself said to have been a victim of the dire disease, and has been in recent years much enlarged and improved. In 1890, 257 patients were under treatment in the asylum. Although the popularity of the institution has necessitated further enlargement, it is the opinion of those best qualified to pronounce on the subject that leprosy itself is not on the increase in the island, and that no case has been known where the disease was traced to vaccination.

The medical and sanitary care of the island is vested in the Civil Medical Department, which was established in 1858. At this date there were hospitals in the principal towns only; but under the fostering care of a paternal government their number has been greatly increased, so that in the year 1875 there were 58 hospitals and four out-door dispensaries, officered by 52 medical men, while at present we count 110 hospitals and 132 dispensaries, distributed throughout the island, with 145 medical men, 23 of whom hold British qualifications. A great impetus to the establishment and extension of these institutions was given in 1870, by the founding of a Medical School in Colombo, which in 1880 was raised to the status of a college with a full professional staff. Epidemic diseases very rarely originate in the island; they are generally imported into the country, the chief being small-pox and cholera.

Medical inspection of vessels, rather than quarantine, is enforced with a view to prevent the importation of disease, and also to limit the spread of it in the island. At the ports of the island there are health officers who inspect vessels on their arrival, and if small-pox or cholera is found on board, the vessel is placed in quarantine generally until the cases are removed, and rarely for a longer period. When small-pox or cholera appears in the island, the infected town or district is proclaimed, and, where isolation is not possible, removal to hospital of the infected person is enforced. The buildings used as hospitals for these cases are mostly of a temporary character—not built of costly materials. The measures adopted on the outbreak of any epidemic disease are so stringent that they are generally effectual in suppressing it at once. Persons found concealing cases are prosecuted in the law courts, and are generally punished in such a way as to deter others from pursuing a similar course. With a view to prevent the spread of small-pox, measures were adopted by Government from an early period. These measures consisted not only in strictly confining infected individuals to their own dwellings, or, where isolation was impracticable, removing them to the hospital, but also in the vigorous enforcement of vaccination.

Ceylon was one of the first countries in the East where vaccination was introduced, and efforts to extend the practice have never been relaxed. Vaccination was introduced into the maritime parts of the

island in 1802, and into the Kandyan provinces in 1816, immediately after they had come under British sway. In all the provinces of the island there are superintendents of vaccination, and every subordinate medical officer in a district is also an assistant superintendent, and under these a number of vaccinators is in constant employment. Great care is taken in the island by promoting and extending vaccination to diminish the number of individuals susceptible to small-pox. Since 1863, vaccination has been made compulsory by an ordinance. In order to meet the prejudice against vaccination on the part of some persons, within the last three years animal vaccination has been introduced to a large extent.

The infectious nature of cholera, or at all events its portability from place to place, is fully recognised in the island, and the measures adopted are in accordance with this view. Boards of health were established in all the provinces of the island more than 38 years ago, and general rules were framed by them to prevent the spread of epidemic or infectious diseases. These boards of health ceased to exercise their functions about 1867, when municipalities were created in Colombo, Kandy, and Galle, the principal towns of the island, and since 1876 local boards of health and improvement have been established in the smaller towns of the island.

The importation of cholera takes place chiefly by means of immigrant labourers from India, who come for employment on the plantations in the central parts of the island. The labourers arrive in the north of the island from the southernmost point of India, and they proceed to their destination along the great north-central road. In order to guard against the danger arising from these immigrants conveying the disease, Government has not only appointed health officers for inspecting vessels, but has also established stations on the road where these people are examined and cared for, besides placing patrols on duty for the care and transport of immigrants who may fall out between the stations.

The proportion of immigrants who used to come to Colombo direct was small, but is now increasing, owing to the facilities offered by steamers and railways, so that out of a total of 84,106 who arrived in the island in 1890, 43,525, *i.e.*, over 50 per cent., landed in Colombo.

Sanitary regulations for improving the health of the country and for preventing the spread of disease were adopted from an early period, but have been more vigorously enforced of late years. Sanitation has been thus progressing. Municipalities, on their establishment, at once commenced to pay attention to sanitary measures. Before the establishment of municipalities, scavenging was not carried out in a systematic manner—parties of prisoners or hired labourers having been from time to time employed in cleansing and removing filth from roads and public places. With the establishment of municipalities in 1867, a daily system of scavenging was introduced. This was done either by means of contract, or by the municipalities undertaking the work by their own officers. After the trial of both methods, preference is now given to the contract system. Scavenging carts ply in the various streets daily, and remove filth of all kinds.

The water-supply in all towns of the island was formerly obtained from wells. In some of the large towns there were public wells carefully guarded from pollution. Kandy was the first town in the island to make efforts to obtain a plentiful supply by means of waterworks. These were constructed in 1878, since when the town has a constant supply of water, brought down by pipes from a reservoir about half a mile from the town. Into this reservoir a stream from the neighbouring hills finds its way. Most householders have availed themselves of the opportunity, and have water carried into their houses. But as regards the general population, the supply of water is derived from standpipes erected in various parts of the town. Unfortunately the stream which supplies the water is not sufficiently guarded, and there are no filtering beds in connexion with the waterworks. The water finds its way into the town by gravitation, and the supply is constant. In spite of the fact that the feeding stream is not quite free from the danger of pollution, the health of the town of Kandy has greatly improved since the introduction of water. Enteric fever and bowel complaints occur less frequently than before. Colombo has had its water-supply since 1887. There is a reservoir at Labugama, 25 miles from Colombo, which is 300 feet above sea level, and water is brought into a service reservoir in the town by means of iron pipes. The reservoir is supplied by streams which have their rise in the neighbouring hills. The hill sides are protected from pollution, and there are filtering beds in connexion with the reservoir. The supply reaching the city in the 24 hours is 3,000,000 gallons, being about 17 to 20 gallons per head of population.

Many of the small towns of the island, formerly dependent for their supply of water on wells, have of late turned their attention to obtaining supplies of water from perennial streams.

In the smaller towns of the island boards of health and improvement have done good service since their institution, in the way of enforcing cleanliness and obtaining purer supplies of water.

The drainage of most of our large towns is unsatisfactory. For the most part the drains are surface ones, which carry away rain water. Something has been done of late years to provide effectual sewerage, but much remains to be done. The proper disposal of sewerage is a difficulty which has often received the consideration of the municipalities.

The dry-earth system is carried out in the public latrines in the towns of Colombo and Kandy. It is also practised in the public institutions. The cesspit system prevails both in the larger and the smaller towns, and no satisfactory method has yet been found of abolishing cesspits in populous places.

The Contagious Disease Ordinance for controlling the spread of venereal diseases was passed in 1867, but repealed in 1888. Public opinion in the island was against this repeal, but its repeal was chiefly owing to similar action having been taken in England. Opinions were divided with regard to the benefits that resulted from the operation of the ordinance.

The prisons, with an average daily population of 3,500, are in a very satisfactory condition. While every endeavour is made by strict penal discipline to make punishment a deterrent from crime, great care is taken to ensure the health and to maintain the physique of the convict. Juvenile prisoners have long been carefully separated from old offenders, and efforts are now being made to establish reformatories and industrial schools for their benefit.

Thus, briefly, has been sketched the sanitary position of Ceylon. There has been, it will have been noticed, a gradual and steady growth of sanitation during the last half-century, but much still remains to be done. With the advance of civilisation and of the material prosperity of the island, and above all with the spread of education among the masses, we may hope in the not very distant future for a clearer perception of the principles of hygiene, and a greater readiness to translate them into practice, with the natural resultant of life being rendered happier and longer.

The Sanitation of the City of Ahmedabad, in the Bombay Presidency.

BY

RUNCHORELAL CHOTALALL, President of the Ahmedabad Municipality.

The city of Ahmedabad is situated in north latitude 23° 1′ and east longitude 72° 37′, on the left bank of the Saburmattee River, about 173 feet above mean sea-level, and 50 miles north of the Gulf of Cambay. The area within the city walls is about two square miles, and contains a population of 124,716 according to the latest census, that of 1891. The jurisdiction of the Ahmedabad municipality extends to the suburbs situated beyond the city walls, the population of which is 18,948, making the total municipal population 143,664 in 1891. The population by the previous census, that of 1881, was 127,210. There are seven cotton mills in Ahmedabad and its neighbourhood, which attract persons from the surrounding districts, and hence the more than normal increase in population. The average rainfall is about 30 inches, and it generally rains during the four months from June to September; the remaining eight months are the fair season.

The soil on which the city of Ahmedabad stands is a very light sandy loam, very porous and dry. The average level of the subsoil water in a fair season stands about 23 feet below the general level of the city.

With such a dry and naturally healthy soil, and such a favourable condition of the movement of subsoil water, Ahmedabad should be a

very healthy city, but, owing to the absence of proper sanitation, it has had the misfortune of showing a very heavy mortality.

There being no drainage system for the removal of liquid filth, all the impurities are being soaked into the soil or evaporated in the streets. For the disposal of sewage and other filthy liquid, a system of cesspools, called "khalcoovas," prevails in Ahmedabad. A "khalcoova" is in construction like a dry well. On a wooden kerb a steining of bricks is built dry without mortar in the joints, so that water may easily find its way through it, and this brick cylinder is sunk to within a few feet of the subsoil water-level. The top of this well, about five feet below ground-level, is arched over with a brick and mortar dome; a connexion with the house drain being made, earth is filled in over the dome. All the sullage water of the house is run off into the "khalcoova"—all the bathing water, the kitchen water, the urine, the washings of the privies, and every conceivable liquid filth. All the liquid thrown into this khalcoova or cesspool filters through the sandy soil at the bottom and sides and finds its way into the subsoil water, and thus these khalcoovas are kept in working order, without opening and cleaning out, for more than 30 or 40 years. But the result of the system has been that water of all the wells in the city is so much polluted as to be quite unfit for drinking. Most of the wells in the city are so badly affected by these khalcoovas that their water is too brackish to be drinkable in any form whatever; however, this water is freely used for washing, bathing, and all other domestic purposes.

But there are some wells in the city, the water of which is not very badly affected, and is, therefore, used for drinking by the people, though under chemical analysis it shows unmistakeable signs of dangerous sewage pollutions.

It will, therefore, be seen that while the water of all the wells outside the city is good for drinking, the wells in the city are so polluted by the objectionable system of khalcoovas that the water therefrom is totally unfit for this purpose. The present system of disposing of the sewage in Ahmedabad is such as to pollute the earth, water, and air, and the result is that the death-rate of Ahmedabad is almost the heaviest in the Bombay Presidency.

From time immemorial there existed a system of deep-well privies in Ahmedabad into which the solid night-soil was collected within the house itself. These privies were also built on the same principle as khalcoovas, with the exception that they were not arched over and were inside the house. They, too, were not cleansed for years, because the owners managed to throw some quantity of salt into the privies to reduce the solid excreta to a liquid state, so that it might soak out through the bottom and sides. The effluvium arising from these well-privies found its way into the house, and was necessarily mixed with the air breathed by the inmates of the house. The nuisance of these deep-well privies was so horrible that on the representation of the Sanitary Commissioner these privies were closed and filled up in the years 1878–79 and 1879–80, and open privies, which could be cleansed

daily, were substituted, and the change was followed by a perceptibly good effect.

There exist returns of the mortality in Ahmedabad for 17 years since 1874, and I have appended a statement showing the population, the total of deaths, and the ratio of deaths per 1,000 of population. I have divided the time into three periods. The first period is of six years, from 1874–75 to 1879–80, when the system of deep-well privies was in existence, and it will be seen that the average death rate of this period was 54·75 per 1,000 of population per annum. The second period of six years, from 1880–81 to 1885–86, is one when all the human excreta from the city were removed and deposited half a mile from the city, and the result has been that the death-rate was reduced to 44·74 per 1,000. But in 1886 the Municipality thought it proper to remove the night-soil depôts from the vicinity of the city to a distance of about three miles in a leeward direction, by laying down a tramway, worked by animal power, and to have the night-soil converted into poudrette to be used as manure; and the result in this third and last period of five years, from 1886–87 to 1890–91, is that the average death rate has been 40·43. The average would have been somewhat less had it not been for the unusual epidemic of influenza in the year 1889–90.

I am glad to state that since the introduction of the system of local self-government, good progress is being made with the assistance and encouragement of Government in the sanitary improvement of Ahmedabad. A line of tramway exists for the removal of night soil, as stated above; and a sufficient supply of water is now an accomplished fact, the new waterworks (the water of which is pronounced by the chemical analyst to be very good) having been opened on the 11th of June 1891, and it is hoped that this will lead to great improvement in the health of the town.

The most important subject of drainage, by which the abominable system of khalcoovas can be done away with, is now under immediate consideration. The Municipality has obtained the advice of the distinguished sanitary expert, Mr. Baldwin Latham, towards draining a portion of the city, and it is hoped that in the course of a year the experiment will be made, which may lead to further extension.

Ahmedabad is not the only city the sanitary condition of which requires to be improved. There are hundreds and thousands of towns in India where the same objectionable system of deep-well privies, and khalcoovas (cesspits), and impure water-supply prevail; but if Government and the municipalities will only do what is necessary, the general death-rate can be so reduced as to save hundreds of thousands of human lives every year.

APPENDIX.

A Return showing Variations in the Death Rate of the City of Ahmedabad in connexion with the disposal of Night-Soil.

No.	Year.	Population.	Deaths.	Ratio of Deaths per Thousand.	Remarks.
1	1874-75	120,318	5,305	44·09	In this period the system of deep-well privies was in existence.
2	1875-76	121,467	6,604	54·36	
3	1876-77	122,615	6,274	51·17	
4	1877-78	123,764	5,585	45·12	
5	1878-79	124,912	8,452	67·66	
6	1879-80	126,061	8,253	65·47	
		739,137	40,473	54·75	
	Average -	—	6,745	—	
1	1880-81	127,210	5,430	42·69	In this period the filth removed from the city was kept in its vicinity.
2	1881-82	128,855	6,825	52·96	
3	1882-83	130,500	5,061	38·78	
4	1883-84	132,146	5,090	38·52	
5	1884-85	133,791	6,123	45·76	
6	1885-86	135,437	6,729	49·68	
		787,939	35,258	44·74	
	Average -	—	5,876	—	
1	1886-87	137,082	4,497	32·81	In this period night-soil depôts were removed at a distance of three miles in a leeward direction.
2	1887-88	138,727	4,719	34·01	
3	1888-89	140,373	6,805	48·48	
4	1889-90	142,018	7,140	50·28	
5	1890-91	143,664	5,217	36·32	
		701,864	28,378	40·43	
	Average -	—	5,675	—	

The City of Bombay.

Delegate:

E. C. K. Ollivant, C.I.E.

The city of Bombay is situated on the western shore of India. Formerly at high tide it was a collection of islets, and at low tide a pestilential swamp studded with eminences. But by the judicious construction of embankments and breakwaters to shut out the sea (the first of which, viz., Hornby Vellard, was constructed during the period 1771 to 1784, during the time of Governor Horaby) and by the construction of roads across what had hitherto been marsh land (the first of which, Grant Road, was built in 1835), and by the gradual reclamation of the low-lying lands, the sea was excluded, and the islets united together at their bases, and thus a mass of land was formed containing an area slightly in excess of 22 square miles. It is an island, or rather a peninsula, connected with the mainland by two causeways and two lines of railway.

The population of Bombay, estimated to be 10,000 in 1662, had increased to 16,000 in 1716. In 1816 the population was 221,550, which had again increased to 810,000 in 1891.

A writer 200 years ago, when describing Bombay, states "the "unhealthiness of the water bore a just proportion to the scarcity and "meanness of the diet," and then adds, "out of every 500 Europeans "who came to live on the island, not 100 left it." Thirty-two years ago 70 deaths in a day from cholera was not an uncommon occurrence. At that date Bombay was dependent for its water-supply on the local wells and tanks, and the average annual number of deaths from cholera alone was returned at 2,241. On the introduction, however, of water from the Vehar Lake, the average was immediately reduced to 507, and in proportion as that supply has become generally adopted a still further reduction has taken place, the return of deaths by cholera for 1890 being 102. "Guinea worm," which was a common complaint in Bombay, commenced to disappear with the improvement in the water supply, and is now almost unknown.

The city is at present supplied with water from two artificial lakes, viz., Vehar and Tulsi, situated in the island of Salsette, distant about 10 miles north of Bombay. These two lakes, with the necessary service reservoirs in the city cost about Rs. 1,15,00,000 (1,150,000*l.* at 2*s.* the rupee). A third lake has been constructed at Tansa, 55 miles away from the city, which, with the duct which is nearly complete, will cost about 1,500,000*l.*, taking the rupee at 2*s.* The Tansa Lake is the largest of the three, having an area of 5½ square miles, and a watershed of 52·50 square miles. It is expected to be completed, with all its accessory works, in March 1892, and is the most costly municipal work yet undertaken in India, while the masonry dam which impounds the water is believed to be the largest in the world. These three lakes will

supply the city with 32,750,000 gallons of water per diem at an average pressure of 100 feet, which, for a population of 810,000, equals about 40 gallons per head per day. The Tansa Lake is capable of supplying a much larger quantity, which can be made use of when the time comes by adding to the capacity of the duct.

Extensive drainage works have been, and are still being, carried out, and up to date nearly 55·33 miles of sewers have been laid at a cost of Rs. 40,96,561 (496,560*l.*). The main principle on which the sewerage works have been designed is to secure segregation of storm-water from the sewage, a necessity consequent upon the concentration of the annual rainfall within a short period of the year, and on the inability to construct channels to do the dual duty of sewers and drains under the variable condition of flow during the dry and wet seasons. Before the new works were commenced, the city was drained by flat-bottomed masonry drains, many of vast dimensions, which received both storm-water and sewage, and which during fair weather became merely elongated cesspools. Under the present project, the main sewers, both masonry and pipe sewers, have been constructed on the most approved and modern principles of sanitation. The sewerage works when completed will cost probably not less than 1,000,000*l.*

As the greater proportion of the thickly populated area of the city is hemmed in on two sides by ridges of high land, the storm-water falling on the inward slope of the latter, and gravitating to that portion of the city which is flat and below high water mark, used to flood it to a very serious extent.

In order to prevent this, large intercepting drains for a length of 5·21 miles have been recently constructed, to cut off the low-lying from the high level district and to carry away the storm-water falling on the latter directly to the sea. The Municipal Corporation obtained last year from Europe the services of the eminent sanitary engineer, Mr. Baldwin Latham, to report and advise on the drainage and sewerage of the city.

Since the passing of the Municipal Act of 1872 special attention has been paid to the maintenance of roads, and to the construction of new roads. The road surface invariably consists of at least 6 inches of macadamised trap rock laid on 6 inches of rubble packing of the same material. Many new roads have been constructed of late years, and many more have been recently sanctioned, especially for the purpose of developing the northern portion of the island, to meet the ever-increasing demand for building land.

The total length of public roads is 142·57 miles, and the total length of private roads is 36·50 miles. The total area of the public roads is 3,674,138 square yards, and that of private roads is 1,599,459 square yards. The total area of paved footpath is 124,354 square yards. The greater portion of the city is lighted with gaslights, and the northern or suburban portion of the city is lighted with kerosine oil lights. There are 3,600 gas lamps, and 1,512 kerosine oil lamps in the city.

Prior to 1872 most of the public streets were narrow and crooked. Since then many of them have been much improved by taking up land on either side whenever opportunity offered, and by throwing the land so taken up into them. This process, however, is slow and expensive, and the old streets in the thickly-peopled portion of the city leave much to be desired.

Several public markets have been provided in the city, of which the Arthur Crawford Market is the most extensive and the most imposing, having an almost world-wide reputation. An extensive abattoir has also been constructed at the northernmost verge of and without the city, where all animals intended for food are slaughtered and dressed for the market before being sent into Bombay. Here also the carcasses are subjected to inspection, and to rejection if found in any way unfit for human food, while the joints are again inspected on arriving at the market.

There are nine public gardens in the city, having a joint area of 179 acres. In the largest of them, the Victoria Gardens, a small zoological collection is maintained.

There are 11 hospitals, to one of which, viz., the Jamsetjee Jeejeebhoy Hospital, the chief medical school of the Presidency, viz., the Grant Medical College, is attached. An asylum and hospital for lepers was erected last year by public subscription, and contains now more than 240 lepers.

The city, forming as it does the terminus of two of the most important railways in India, viz., the Bombay, Baroda, and Central India Railway, and the Great Indian Peninsula Railway, with its magnificent harbour, affording unlimited protection to shipping of any burthen lying in mid-stream, and also safe and convenient landing at its several wharves and docks (especially the Prince's and the Victoria Docks), has become the chief emporium of trade in India. The average total trade per annum, both export and import, amounted to Rs. 1,38,00,000 at the commencement of the 19th century, and had increased to Rs. 83,18,66,426, or nearly 60-fold, in the year 1889.

Statistical Summary.

Population, 1891, 810,000.

Average death-rate per 1,000 for the last five years, 24·55.

Maximum temperature of air, 100°·20; mean temperature of air, 79°·13; minimum temperature of air, 53°·30; average annual rainfall from 1843 to 1889, 70·97 inches.

Maximum daily rainfall (6th June 1886), 16·10″; maximum hourly rainfall (12th June 1847), 4·22″.

Length of public roads, 142·57 miles; length of private roads, 36·50 miles; area of public roads, 3,674,138 square yards; area of private roads, 1,599,459 square yards; area of paved footpath 124,354 square yards.

Number of gaslights, 3,600; number of kerosine oil lights, 1,512.

Length of brick and pipe sewers, 55·33 miles.

Annual municipal revenue, Rs. 53,42,170; rate of taxation per head (consolidated) $15\frac{3}{4}$°/₀ on the gross annual rental minus 10°/₀.

Rateable value of properties in Bombay, Rs. 2,73,64,359; number of buildings, 33,106.

Area of Tansa Lake, 5,713 acres; area of gathering ground for Tansa Lake, 33,600 acres.

Area of Vehar Lake, 1,400 acres; area of gathering ground for Vehar, 3,900 acres.

Area of Tulsi Lake, 331 acres; area of gathering ground for Tulsi, 1,714 acres.

Water-supply per head when Tansa Lake is finished, 40 gallons.

Number of fire brigade stations, 9; number of steam fire engines, 7; number of manual engines, 7.

Tram lines (double track), 10·27 miles; tram lines (single track), 7 miles.

Number of public gardens, 9, with an area of 52 acres.

Value of important public buildings, Rs. 1,50,00,000; steam roller for roads, 20; spinning and weaving mills, 69; presses, 6.

Sanitary Improvements in the City of Calcutta.

BY

H. J. S. Cotton, B.C.S., Secretary to the Government of Bengal, Delegate from the Corporation of Calcutta.

The underground drainage system of Calcutta was commenced in 1859. The total expenditure incurred on the work up to the 31st March 1890 is about 110 lakhs of rupees.

The number of premises connected with the sewers is 25,938. There are 37 miles of main or brick sewers, and 147 miles of pipe sewers. The enormous improvement effected by the obliteration of the old open drains—an elongated cesspool, as they have been called—and the substitution of underground drainage in their place, can only be appreciated by those who remember Calcutta in former days; but it may still be partially realised by a visit to the suburbs of the town, where open drains still exist. A survey for the systematic drainage of the suburbs is now in progress.

The total capital sunk in the Calcutta Water Works is, in round numbers, Rs. 1,42,72,000, of which nearly half has been spent on extensions of the original scheme. This outlay has been amply repaid, not only by the improved health of the inhabitants, but also by the increase of wealth and material prosperity which the reputation for good drinking water has attracted to the city. It was officially stated in November last that there were 990 standposts on the filtered, and 2,505 ground hydrants on the unfiltered system. The number of house ferule

connexions was 16,321. The daily supply had then reached an average of 35·4 gallons of filtered water, and 8·9 gallons of unfiltered water per head of the population. The filtered water is of the highest possible quality of purity.

The roadway of the town has been augmented during the past 12 years by about 10 per cent., and the area of roads watered by 33 per cent. The lighting of the town has increased from 3,418 lamps to 4,892. The quantity of refuse removed from the town has more than doubled, having increased from about 80,000 to more than 201,000 tons. About 240 impure and insanitary tanks have been filled up, and tanks other than those in private enclosures are now very rare in any part of the town, except the extreme north. In the place of tanks, the town has been studded with 86 bathing platforms for the use of the poorer inhabitants. Six public squares have been constructed and laid out at considerable expense, to the great advantage of the people living in the neighbourhood. Organised measures have been adopted for the reclamation of bastees,* at a cost of more than 10 lakhs of rupees.

It was observed by one of the late health officers of Calcutta, in a published address, that "Calcutta has, to sight and sense, within living memory, undergone a revolution"; and it may be added that during the past 12 years the changes effected have been more rapid and decisive than in the 20 years which preceded them. Dividing these years into three quadrennial periods, it is found that, during the first of these periods, the total number of deaths was 62,226, during the second 49,863, and during the third 45,793. But the improvement is most marked in its effect upon the wealth of the town. It is stated to be, on the whole, a very moderate estimate that, while the population has practically remained stationary, the value of land has more than doubled since 1878, and that the increased value to the owners is about nine crores of rupees. It would be difficult to produce a more decisive tribute to the wisdom of sanitation.

The present recorded death-rate of Calcutta varies from 25 to 30 per thousand. These statistics, however, place the public health of Calcutta in a fictitiously favourable light. The population is largely an immigrant one, and more than half consists of individuals who are in the full vigour of manhood and womanhood, the majority of whom, when they become seriously ill, leave Calcutta for their homes. On the other hand, it is usual among persons of the respectable and middle classes, when they are old or ill, to come into Calcutta on account of its superior sanitary attractions, and for medical attendance. But while the death-rate cannot be accepted as an absolute test of the health of the city, the statistics do enable a comparison to be made of the mortality in different years; and it is highly interesting to notice the great diminution in the number of deaths from such principal diseases as cholera and fever since the drainage works have been constructed, a pure water-supply given, and other sanitary improvements set on foot.

* Clusters of huts inhabited by the poorer classes.

The mortality from cholera in Calcutta has been carefully registered for the past 50 years, and the average annual number of deaths from this cause during each of the five decades is as follows :—

1840 to 1889.	Average Annual No. of Deaths.
First decade, 1840 to 1849 - - - - -	4,818
Second decade, 1850 to 1859 - - - -	4,261
Third decade, 1860 to 1869 - - - - -	4,747
Fourth decade, 1870 to 1879 - - - -	1,327
Fifth decade, 1880 to 1889 - - - - -	1,640

There is, no doubt, a marked periodicity in the mortality from cholera, which seems to point to some biological law in the life-history of cholera contagion. The synchronous rise and fall of cholera in Calcutta and in the neighbouring districts of Bengal is of almost invariable occurrence. Calcutta is affected by causes not peculiar to itself, but common to all the neighbouring localities, and although the incidence of mortality is now low in Calcutta in consequence of the extensive sanitary works which have been undertaken, a more or less corresponding ratio continues to exist between Calcutta and the adjoining populations. It is owing to this periodic intensity of an epidemic wave of cholera, more than to any other cause, that the average number of deaths during the 10 years from 1880 to 1889 exceeds the average of the previous decade. During 1882, 1883, and 1884, there was a violent outburst of cholera, not in Calcutta only, but throughout the neighbouring districts. It is also true that during the 30 years which preceded the introduction of a pure water-supply, *i.e.*, before 1870, there was a similar periodicity in the cholera death-rate: but during that period the lowest annual number of deaths was 2,268 (in 1867) and 2,502 (in 1848), and the highest was 6,826 (in 1866), 6,553 (in 1860), and 6,427 (in 1846), whereas after the introduction of the water-supply the lowest annual death total has been 796 (in 1871) and 805 (in 1880), and the highest 2,272 (in 1884). Generally speaking, therefore, it may be said that during the last 20 years, when a pure water-supply has been available, the cholera mortality is only one-third of what it was in former times. It may be admitted, as an eminent authority, Dr. J. M. Cuningham, has pointed out, that the fall in cholera mortality in 1870 was partly due to other causes, and that it was pronounced before one drop of water reached the city: but, be this as it may, the comparative average immunity which has persistently prevailed since 1870 can only be explained by attributing it to the improved water-supply which dates from that year. The change which has taken place in Calcutta in regard to cholera is indeed extraordinary, and sanitarians may well appeal to the evidence of these figures as demonstrating with mathematical certainty that sanitary reform, and, above all, the supply of pure water, is the only effectual method for controlling this terrible disease.

With equal confidence may they point to the statistics of the mortality from fever. The following statement, which is derived from the report of the Calcutta Municipality for the year 1888–89, shows in triennial periods for 12 years the average annual number of fever cases treated in the hospitals of Calcutta and the average annual mortality:—

Years.	Average Annual No. of Hospital Fever Cases.	Average Annual Mortality from Fever in Calcutta.
1877 to 1879 - -	41,670	5,344
1880 to 1882 - - -	31,835	3,726
1883 to 1885 - -	27,497	3,630
1886 to 1888 - - -	24,704	3,291

The marked and continuous improvement, equally apparent in the hospital returns as it is in the health officers' statistics, is attributable to the completion of the drainage system, the consequent obliteration of the surface ditches, the increased dryness of the subsoil and the work done by an organised sewerage service. The figures are, moreover, borne out by common experience. The comparative immunity from ever enjoyed by residents in Calcutta as compared with residents in the suburbs and in the country is so notorious that persons suffering from fever frequently come to the city under medical advice as to a sanatorium.

Still, satisfactory as these results may appear at first sight, satisfactory as is the enormous increase in the value of landed property, and even more satisfactory the perceptible diminution in mortality, in truth, so much remains to be done to improve the sanitary condition of Calcutta that what has been done can only be pointed to as an encouragement to further exertion.

When all has been said, it must be admitted that the conditions of life in the metropolis of British India are still highly insalubrious. The cholera map of Calcutta is still simply a map in which the whole of the native town appears one mass of red dots indicating cholera deaths, and the inspection of this map with its record of more than 1,000 cannot fail to awaken a sense of how much remains to be done to improve sanitation. The Health Officer of the Corporation has lately called attention in the most prominent manner to the ventilation of the city by proper streets and squares and to the enforcement of proper building regulations as the most important sanitary measures which it remains to undertake. Pure air is as much a necessity for the public health as pure water, and the overcrowding of buildings not only impedes the circulation of air and disseminates disease along the poisonous alleys which divide house from house and harbour the germs of all disease, but it prevents the possibility of laying down efficient drainage and hinders and adds to the cost of scavenging. The ground of Calcutta is literally covered with houses without open space between them; and narrow streets, winding

lanes, and zigzag passages afford complete obstacles to thorough ventilation. The statistics which the municipal reports furnish indicate the radical structural defects of Calcutta as a residential city. The roadway of the town extends over 184 miles, of which only 28 miles are roads of 32 feet in width and upwards; 103 miles vary in width from 9 to 31 feet, 17 miles are less than 9 feet in width, and 34 miles are sewered ditches, which, from the nature of the case, are often not more than 3 feet in width. The fine new street, known as the Central Road, which the Municipal Commissioners have, at great expense and with much public spirit, lately determined to cut through that overcrowded and overbuilt portion of the city, is a very important and valuable sanitary improvement. This road is now nearly complete. But it will exercise only a small influence in doing away with the evil of congested and unregulated buildings, unless streets from north to south and from south to north be constructed to meet it. The great structural defect which prevails, especially in Burra Bazaar, but also throughout the whole of the heart of Calcutta where the residents of the city dwell, is, and always has been, due to the toleration of too many houses and too many people on too limited a space, instead of forcing them to spread out on a wider area. The plan of construction of the city being radically defective, the supply of every other sanitary improvement is only palliative while that constitutional defect remains. It will never be possible to wipe away the reproach under which Calcutta labours as the home of cholera until the present germ-laden air is as purified from contagion as is the filtered water now drunk by the people.

In conclusion, it must be added in justice to the Corporation of Calcutta, that the Municipal Commissioners are fully alive to the urgent necessity of energetically pursuing the course of sanitary improvement. Immense as are the difficulties of introducing sanitation into an Oriental city according to the western ideas of the present day, the problem in Calcutta is now in process of solution. Enormous sums have already been spent, and will continue to be spent; but it must be remembered that progress can only be gradual, and that the local authorities are hampered not only by financial considerations, but by the conservative habits of the people, which in the eyes of a sanitary reformer appear too often to be purely obstructive. It must be remembered, also, that the secret of overcoming this obstruction is to be found, not in attempting to coerce popular feeling by persistent condemnation, but in conciliation and sympathy.

The City of Rangoon.

BY

Major R. C. TEMPLE, Indian Staff Corps, President of the Rangoon Municipality.

Delegates.

J. THOMPSON, Esq., late Vice-President, Rangoon Municipal Commissioners.

H. M. MATHEWS, Esq., M.I.C.E., late Manager and Engineer-in-Chief, Burma State Railway, and a Municipal Commissioner, Rangoon.

O. D. CLARK, Esq., A.M.I.C.E., late Engineer to the Rangoon Municipal Commissioners.

S. G. JONES, Esq., late a Municipal Commissioner in Rangoon.

Rangoon, the capital of Burma, is situated 21 miles from the sea on the left bank of the Rangoon River, at its junction with the Panlang Creek, the Pazoondoung Creek, and the Pegu River, having surburbs on the right bank of the Rangoon River and on the left bank of the Pazoondoung Creek. As a village, Rangoon, under the name of Dagôn, was, according to the legend usually accepted by the Burmese, founded about 585 B.C. by two brothers, Poo and Ta-paw, who erected the Shway Dagôn Pagoda on a slight laterite ridge over some hairs from Buddha's head, which they had received from Buddha himself, and which they buried there. The village seems to have disappeared from history for long periods, but it was rebuilt and called Aramana by Poonnareeka, the King of Pegu, about 747 A.D. The Burmese occupied it in 1413 A.D. The town often afterwards changed hands and was frequently the scene of struggles between the Burmans and the Talaings, but eventually, in 1763, Alompra captured it for the Burmese, repaired the Pagoda, and named the town Yangoon or, as the Europeans call it, Rangoon, making it the seat of a Viceroy. The town was first occupied by the British from 1824 to 1827, when it reverted to the Burmese. It was again captured in 1852, from which date it has remained in British possession.

In 1852 Rangoon contained but a few offices and principal buildings, situated about one and a half miles from the river, what there was of a town being a collection of bamboo and plank houses and huts built on piles over a swamp partly flooded at spring tides. The spaces beneath the houses are described as being almost invariably receptacles for fæcal matter, dirt of all descriptions and stagnant water, from which, during the heat of the day, pestilential vapours constantly ascended.

It is almost needless to say that the English Rangoon of 1891 bears no resemblance to the Rangoon of 1852. Until 1874 municipal matters were in the hands of the Local Government, and in that year the first Municipal Committee took over the management of the town which was

then without lights, a proper supply of water, or means of drainage. The exertions of the Government had been devoted to raising the centre of the town above tide level, providing land fit for building purposes, and making roads, bridges, culverts, and surface drains, but these had been only imperfectly, and to a limited extent, carried out before 1874.

Up to 1873 no attempt had been made to deal with sewage and, consequently, the land was honeycombed with cesspools, and the drinking water was little else than diluted sewage. In that year the Local Government ordered the cesspools to be closed, and introduced a system of night scavenging from house latrines and the removal of night-soil in carts to jetties on the river bank, where it was thrown into the river. This horrible system, which polluted the air of Rangoon throughout the night and made traffic in the streets a severe task, remained in force until last year, when it was superseded by the Shone system. The Shone system was adopted after severe criticism and mature deliberation as being really the only one by which the sewage of a flat, tide-locked town, like Rangoon, could be sanitarily dealt with, and, although the town was young and poor, it was thought that 175,000*l.*, the cost of the work, would be well spent if the system fulfilled its promises. Most exhaustive trials have been made of the works, which have now been in operation nearly two years, and the result has placed it beyond doubt that the favourable estimate originally formed of the Shone system has been completely justified by the result of its working. Rangoon is now the only city in the Indian Empire which can boast of a scientific system of drainage which fulfils all the requirements of sanitarians.

Unfortunately house-connexions in Rangoon are few in number, and until they are completed the full value of the perfect drainage system available in the town proper cannot be obtained, but this evil is being decreased daily and, to remedy it effectually, a new Municipal Act is proposed giving full and complete power to the municipal authorities to insist upon house-connexions. The works of the Shone sewage system include 6 miles of sewage mains, 22 miles of gravitating sewers, $4\frac{3}{4}$ miles of air mains and 44 Shone's ejectors.

The water used in Rangoon previous to 1878 was derived entirely from wells and tanks, and, in what is called the town proper, that is, the business and most crowded portion of the city, it was highly polluted. Cholera was always present and small-pox was endemic. In that year a main was laid from the Royal Lake in Dalhousie Park to Pazoondoung, where most of the mills and factories are situated and where a large coolie population was resident. Cholera was so frequent and disastrous in its consequences in this portion of Rangoon that this main was laid as a temporary measure, until a scheme for a proper water-supply could be carried out. The effect on the health of the neighbourhood supplied with good water was instantaneous; cholera practically disappeared and since then has never reached epidemic proportions.

In 1883 waterworks for the town proper, Pazoondoung and the shipping were completed, and now the Municipal Committee is about

to carry out filtration works and to increase the supply of water, as the city is growing so fast that the demand is already rapidly outstripping the supply.

Water is supplied to a large portion of Rangoon at present from a reservoir about five miles distant and near a village called Kokine. This reservoir, called the Victoria Lake, was made by forming embankments joining small hills between which streams ran in the rains, and from it the water is conveyed by iron mains to the Royal Lake, which thus forms a distributing reservoir. The cost of these works was 200,000*l.* High-pressure is obtained by the adoption of the Shone System. Twelve ejectors, each of 500 gallons capacity, have been fixed in an ejector-house near the Royal Lake, and to these the water gravitates. Compressed air has been laid on to the ejectors and a head of 62 feet is obtained by this inexpensive, clean and simple system. The works cost about 20,000*l.* and the expense of their maintenance is trifling, as the machinery that compresses air for the sewage works does the same work for the high-pressure waterworks, and no extra establishment, beyond a caretaker and some watchmen at the Ejector Station, are necessary. A few mill-owners are able to supply themselves with water from artesian wells, but the majority of them purchase water from the Municipality, and the railway and shipping take their supplies almost entirely from the Municipality.

The town proper of Rangoon, and one of the suburbs named Kemendine, are laid out on the block system, each block being 800 feet long by 860 feet wide, having 1CC feet streets on all four sides and being intersected at every 115 feet of its width by streets, four of which are 30 feet wide, and one, in the centre of the block, being 50 feet wide. In the extensions of Rangoon to the east and west it has been decided to have no streets less than 50 feet wide.

The lighting of the town extends over 42 miles of roads, and the lighting of some portion of the remaining 50 miles is now suggested. Kerosine oil is the illuminant used.

Rangoon, as before remarked, formerly consisted almost entirely of plank or bamboo houses, and 15 years ago masonry buildings were few and far between. Of late, however, as wealth has increased, good masonry houses have more and more replaced insanitary wooden shanties, and powers will be given to the Municipal Commissioners in the proposed Municipal Act to prescribe the materials of which buildings may be constructed in any particular quarter.

Good slaughter-houses have been built at a cost of nearly 10,000*l.* to replace a wretched shed, which formerly did duty as an *abattoir*, and it is in contemplation to construct a cattle market and sheds and to keep animals a certain length of time before allowing them to be slaughtered.

Rangoon has excellent pleasure grounds; two large commons, which are available for military purposes and for races as well as for links and other public uses; a garden in charge of the Agri-Horticultural Society; an extremely pretty and well-kept garden in the Cantonments;

a large square in the heart of the town proper; and, in addition to these, the Royal Lake and Dalhousie Park, which together form one of the finest recreation grounds which any city can boast of, comprising as they do 295 acres of well-timbered park land and 160 acres of water.

The Civil General Hospital has accommodation for 300 patients, and last year 6,192 in-patients and 37,168 out-patients were treated in it. The Commissioners are about to spend 7,000*l.* in improving the sanitary and other arrangements of this hospital. The Military authorities have their own hospitals in the Cantonments. The Dufferin Institute for providing female medical aid to women has a branch and a small hospital in Rangoon, and endeavours are being made to raise sufficient money by subscription to build a good hospital for the purposes for which the Institute exists.

Contagious diseases (cholera and small-pox) are treated in separate hospitals built outside the most crowded part of the town. The buildings have bamboo mat walls, which answer every practical purpose, and which, being inexpensive, can be taken down and burnt when necessary. Unfortunately, in consequence of agitation in England, the Lock Hospital, which was of inestimable benefit, has been closed.

There are three Municipal, and eight private markets in Rangoon, but their condition admits of great improvement and is now receiving considerable attention at the hands of the Municipal authorities. The markets in Burma are really the most important retail business places in every town. In them nearly everything required by the public, whether food, drapery, clothing, hardware, stationery, medicine, perfumery, toilet requisites, or jewelry can be purchased; people meet there to buy, to sell, to gossip, to flirt, or to gather information; in fact, the English idea of a market conveys no correct impression of one in Burma.

Religious buildings and lands occupy an enormous area of Rangoon compared with its total size. Christians, Buddhists, Hindus, Mussalmans, Pônnâs, Parsis, and Jews all own lands and churches, pagodas, kyoungs, temples, mosques, or synagogues. The Buddhist kyoungs are, many of them, filthy, and a source of danger to the health of the city, but for reasons of policy a considerable amount of leniency has to be used in dealing with the religious buildings and customs of indigenous races in the British Empire in the East.

Burial grounds existed originally in every direction and were several years ago fixed in what was then the outskirts, and is now fast becoming the centre, of the city. A large necropolis is being prepared outside Rangoon, and most of the present graveyards, many of which are in a dangerously overcrowded state, will soon be closed. Cremation is not much practised in Rangoon unfortunately, although the population consists largely of Hindus.

The population of Rangoon was in 1812, 8,250; in 1826, 8,660; in 1863, 61,138; in 1872, 98,745; in 1881, 134,176, and in February 1891, 181,071. During the decade from 1881 to 1891 Rangoon passed through two years of great trade depression caused by the demoralisation

consequent on the war in Upper Burma. The population undoubtedly decreased then, and the increase in the whole period is therefore all the more remarkable.

The aggregate death-rate of Rangoon is very high, being over 39 per mille. This is due to two causes. Firstly, the swampy nature of the outskirts of the town proper, which the poorer classes are compelled to use in their present state, as no other land is available. Secondly, there is a large annual Hindu immigration to the mills and factories from the lower orders from the Madras Presidency. The death-rate is found to be highest where the land is low, and among these Hindus. It is they that are the cause of the small-pox existing in the town and that contribute more than half the deaths from cholera and from bowel complaints. Strenuous efforts are being made to improve their lodgings and their present surroundings. A scheme for reclaiming the low lands of the town, to cost about 500,000*l.*, is now being considered in detail, and, when it is accomplished, say during the next decade, the death-rate of the town may be expected to be as low as that of the non-Hindu population, or about 26 per mille. That the death-rate need not be high owing to climate is proved by that of the Christians, who live in a cleanly manner and under sanitary conditions, and amongst whom the death-rate is less than 17 per mille.

Since compulsory vaccination was introduced in 1885, small-pox as an epidemic disease has disappeared from Rangoon, and what of it still occurs is invariably imported by the Madras coolies either from their own country or from the harvest fields of Burma. As showing the effects of compulsory vaccination it may be mentioned that in the six years ending with 1884, the average number of deaths per annum from small-pox was 353, while in the six years since 1884 the average number has been 39 per annum.

It is also interesting to note the effects of the introduction of a fairly pure water-supply into the town; firstly, in 1879, and secondly in 1883. In 1879 water was introduced into the suburbs of Pazoondoung, and the average number of deaths from cholera, which in the three previous years had been 231, was reduced in the next three years to 65. In 1883 water was laid on to the town proper, and the average number of deaths from cholera was reduced from 155 per annum in the six previous years to 59 per annum in the six succeeding years.

The Desirability of establishing a Special Tropical Section in connexion with future International Congresses of Hygiene.

The Chairman (Sir M. Grant Duff) called upon SIR WILLIAM WEDDERBURN, Bart., Delegate for the Poona Sarvarjanik Sabha, to move a *Resolution.*

SIR W. WEDDERBURN thought the meeting would be of opinion that it would be well that India, and countries similarly situated, should have a more full opportunity of bringing forward the sanitary questions in which they were interested. It was therefore proposed that a tropical section should be formed, in order that discussion on such questions might be focused, rather than distributed among different other sections. He might mention that India had very short notice of this Congress, but she had responded very liberally from a financial point of view. She had also sent delegates and numerous papers to be read. All European States were necessarily interested in diseases arising in tropical latitudes, not only from altruistic motives, but also for the protection of their own people. Sir W. Wedderburn concluded by moving the following *Resolution :—*

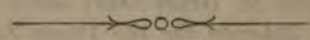
> "That, looking to the interest shown by India in this Congress, and considering the probability that other tropical countries and colonies would take a similar interest in future Congresses if a more prominent position were given to the consideration of subjects in which they are specially concerned, this meeting recommends to the Permanent Committee, that in future Congresses a Tropical Section be formed, with a view to a more full discussion of questions affecting sanitation and the origin of disease in tropical climates."

SIR DOUGLAS GALTON, in seconding the resolution, urged the importance of the question, but observed that the arrangement for each Congress rested with the promoters of the Congress in the country in which it was held. The last Congress held in Vienna had only five sections. The next Congress would be held probably in Budapesth, and it would depend on the gentlemen who organised the Congress to arrange the sections. At the same time, it was to be observed that in order to obtain a certain degree of uniformity in the proceedings of successive Congresses, the Permanent Committee of the International Congress had decided that morning to appoint a sub-committee to prepare a scheme for the constitution and regulation of the Congress; Professor Corfield was the English member of that committee, and if the resolution be passed, he would undoubtedly take steps to have the question duly considered by that sub-committee.

PROFESSOR CORFIELD said he had been requested to speak as Foreign Secretary of the Congress in support of this resolution, and was happy to do so. He was very glad that it had been proposed to form a general tropical section, and not merely an Indian one, as many countries

would be interested in the work of such a section. As the English member of the committee of five which had been appointed that morning to prepare a scheme for organising the next Congress, he would promise that the matter should be carefully considered by that committee.

The Resolution was carried with acclamation.



DISCUSSION.

After some remarks from **Dr. Leitner,** one of the Delegates of the East India Association, and of the Mahomedan Literary Society, Calcutta, **The Chairman** said he was only expressing the feelings of those present when he thanked the gentlemen who had read the very interesting and important papers which they had listened to, especially those that had emanated from native sources. The Chairman asked the meeting to return thanks to a number of native gentlemen of high position who had assisted the Congress to a very great extent, and who were always foremost in all good works connected with their country. Their names were the Nizam of Hyderabad, the Gaekwar of Baroda, the Maharaja of Mysore, the Maharaja of Jeypore, the Maharaja of Bhavnagar, the Maharaja of Travancore, the Maharaja of Vizianagram, and the Maharaja of Cooch Behar. The proposal was carried by acclamation.

Sir Owen Burne then said:—Before we conclude our proceedings, I feel sure that you will concur with me in expressing our grateful thanks to Sir Mountstuart Grant Duff for so kindly presiding over our meetings of yesterday and to-day, at no small inconvenience, it is believed, to himself. It might be considered an intrusion on my part were I to take up your time by dwelling on the importance of these meetings, and it might be equally out of place, perhaps, if I were to refer in any detail to the career of one with whose public services you are all so well acquainted. I will merely remind you, therefore, on the present occasion of the keen interest which our Chairman has taken throughout a long public life in the all-important questions which have been discussed in this room, and of the foremost place which he has held, by his example and by his ability, in the ranks of those valued statesmen who have contributed to the progress and stability of the Queen's Empire. As to India, it hardly requires to be said that by his work in years gone by as Under Secretary of State for India, and afterwards as Governor of one of the most important parts of that great dependency, the name of Sir Mountstuart Grant Duff will ever be associated—and honourably associated—with her political history, and will be connected in no inconsiderable manner with the welfare and happiness of her people. On these grounds alone, without mentioning other claims which Sir Mountstuart Grant Duff has on our appreciation, I now ask your cordial concurrence in the expression of our thanks to him for so ably presiding over that part of the International Congress of Hygiene in which India has taken so gratifying a share.

Sir Charles Lawson said:—I have much pleasure in seconding the proposition which has been so ably moved by General Sir Owen Tudor Burne, for it was my privilege to reside in Madras during the whole of the five years that the chairman filled the office of Governor of that Presidency. We have heard during this meeting a great deal about

Bombay, and some persons who are not familiar with the divisions of the country may have been led to the conclusion that Bombay and India are convertible terms. But Bombay is not India. It may at the same time be admitted that Bombay is the most progressive part of India, and that it contains the commercial capital of India, of which all India is proud. A former Surgeon-General of Bombay has read a valuable paper on sanitary matters in India in general; and a former Member of Council of Bombay, a former Chief Secretary of the Bombay Government, and several officers of the Bombay Municipality have favoured us with their opinions on sanitation in Bombay in particular. These speakers have typified the great interest that is taken in sanitary research and progress by all classes of public functionaries in India. For it must not be supposed that Bombay has the monopoly of such men. Madras does not claim to have better men than those connected with Bombay; but she does maintain that she has equally good men, who are equally desirous to assist in the promotion of public health in England's greatest dependency. There is a yet higher grade in the official organization of India than any which has been represented by the speakers referred to, namely, that of the Governors, to which Sir Mountstuart Grant Duff belonged; and it is but fair to mention that as Governor of Madras he evinced that he, too, had a deep sympathy with sanitary activity. He travelled far and wide about the Presidency; he inspected numberless hospitals, jails, markets, schools, and other institutions; he gave the most cordial support to Surgeon-General Cornish, Surgeon-General Furnell, and Surgeon-General Bidie, the successive heads of the Medical Department who served under him; and he did all that the means at the disposal of his Government allowed to make the land healthier for his presence in it. It fell to his lot to inaugurate the opening of a large section of the new drainage works of the Presidency capital, and in the magnificent thoroughfare by the sea, known as the Marina, which owes its existence to his initiative, he gave that town what it had long needed, namely, a new lung. There was consequently much appropriateness, in this meeting being presided over by one who is honourably associated with the promotion of good sanitary work in the oldest of the three Presidencies, and I therefore heartily commend the proposition to your acceptance.

The vote was carried by acclamation, and, the Chairman having responded, the meeting terminated.

FURTHER
PAPERS AND DISCUSSIONS

Reprinted from Volumes I., VII., VIII., IX., and X.

The Prevention of Fever in India.

BY

Surgeon-General Sir WILLIAM MOORE, K.C.I.E., Q.H.P.

[NOTE.—This paper is reprinted from Volume I.]

Fever throughout the Indian Empire is the most prevalent of all maladies, and had time allowed, I would have prefaced my observations on prevention with some account of the phases of fever met with in India. This, however, is impossible, so I at once proceed to prevention.

The prevention of fever must be considered under two heads:—

1st. What can be done by authoritative sanitary regulations?

2nd. What should be done in the matter of personal hygiene?

And it is desirable to consider these heads separately, as regards the Anglo-Indian resident, including the British soldier; and as respects the civil population.

In European stations and military cantonments much has been accomplished. Surface cleanliness is now almost perfect. Before I left India I heard a lady complain, that if her goat went out it could not pick up a straw! In many cantonments magnificent upper-storied barracks* have been built, generally with rooms for 12 to 25 men. Plunge baths, work and recreation rooms, have been provided, while conservancy arrangements — usually hand-work — are carefully supervised. In some stations better bungalows for officers have been built. Much, however, remains to be accomplished. For instance, the Queen's Regulations for the Army state, that no man shall go to the tropics until thoroughly drilled; practically this is not the case. Again, principally as a result of the short service system, men are sent out too young; and this, notwithstanding repeated recommendations that they should not be sent out until 22 years of age, and notwithstanding the fact that young men in India are excessively liable to fever, especially to enteric fever, which is more fatal in India than in Europe. Then the season of arrival in the tropics is (perhaps unavoidably) not always well chosen. For example, the "Crocodile" went out in the end of February last, and the "Euphrates" on the 9th of March, each having upwards of 1,000 troops on board. Next, arrangements should be made for men to be sent first to hill stations, or at least to selected stations, instead of their being invariably sent to the station where the regiment they are to join happens to be. A more free use should be made of the hills, especially for working-parties in the hot weather.

* These barracks, being built on a standard plan, are rather a mistake. For no one plan of barrack or house is suited to every varying climate of India. The climate demands modifications, which have not been sufficiently considered, or at least authorised.

But when Europeans go to the hills, greater care in the way of warm clothing is required *at once*, fever or diarrhœa often resulting immediately from a mountain chill. Some military stations have been abandoned as too unhealthy, but there are still some notoriously unhealthy barracks and bungalows. Such should be abandoned at any cost. Barrack rooms should be so constructed as to admit of each man being partially screened from his neighbour. Over-ventilation is a most fertile cause of chill, and chill is a most prolific cause of fever. Over-ventilation should be guarded against as much as under-ventilation. Ventilation in barracks is often excessive. If the doors and windows are open the men sleep in a draught and get chilled;* if shut, the men breathe the emanations from their lungs and bodies. There should be small windows above each bed, and so protected that draught on the person is impossible, while the most thorough current is secured above. Subsoil drainage requires more attention. In few stations is there any subsoil drainage. But water passing through the subsoil under dwellings, and mounting by capillary attraction into plinths, is a matter seriously affecting health. Absolute disconnexion between the floors and the earth would be a substitute, but in the Bombay command there is not any barrack thus built. Neither is sufficient attention given to the construction of impervious shallow drains to carry away roof-water † from barracks and houses. The dry-earth system of conservancy is generally adopted. But men often neglect to use the earth, which use should be insisted upon, or self-acting hoppers should be supplied. In my opinion, a mixture of ashes, charcoal, and lime is superior to earth, as less of bulk is necessary, and such a mixture would tend to destroy germs, while earth is simply a deodoriser. But lime must not be brought into contact with urine, as ammoniacal gases are then evolved. In various localities where the natives will not yet use human ordure as manure, the mass is conveyed to some secluded spot, and deposited in pits, which is wrong.

In other localities it is buried in trenches, the ground being afterwards sometimes ploughed and sown. It has been frequently advanced that by this wholesale disposal of fæcal matter germs of disease may be placed in the soil to be liberated hereafter. I am strongly of opinion that every effort should be made to convert ordure into manure, and to induce the natives to use it for the fertilisation of the fields. It was mentioned that plunge baths had been provided. More strict orders should be enforced against men staying in the bath too long, which is frequently followed by fever or liver disease. Also, it should be insisted upon that men wash more thoroughly, for some do not wash the lower

* In the Report on Sanitary Progress in India for 1875, it is stated, that at Nusseerabad, fever admissions dropped suddenly from 953 per 1,000 to 430, after closing the windows at night to the prevailing wind.

† Roof water is supposed to be collected in iron vessels or chunamed pits, but the wind continually blows it on the adjacent ground, and the receptacles often run over.

parts of the body for days. A regimental wash-house for clothing should be provided, and native washermen should not be permitted to take clothing to their houses in the bazaars. Natives of India from experience know the value of the "cummerbund,"* and wearing a flannel belt over the whole of the abdomen and loins should be made obligatory; for a congested kidney is, I believe, not infrequently a cause of fever, and an abdominal chill may certainly be the immediate exciting cause of diarrhœa, dysentery, or even cholera. Arrangements should be made for a change of clothing when coming in perspiring from parade or exercise, instead of allowing the clothes to dry on the body in a draught The soldier goes too long without food. His meals are too close together. Provision should be made for an evening meal, and a less heavy dinner in the heat of the day.† A *free* ration should be given in the early morning of biscuit, bread, tea, cocoa, or still better, coffee, which is both stimulating and antiperiodic.

It is known that the temperature rises after food, although only in a small degree. An early morning meal was formerly supposed, in some mysterious manner, to prevent the noxious influence of malaria. But I say that the benefit resulting from the practice is consequent on its rendering the system less liable to be affected by the fresh chilly morning air. The men should not be allowed to supplement their rations with bazaar pork, for a condition resembling typhoid may be caused by trichinæ. It would be well if a bread-making machine were universally used instead of the unwashed sweaty hands of natives.‡ Much care is taken with regard to the milk supply, to which typhoid has been attributed. Unless Government take the milk supply into their own hands, it is difficult to see what more can be done. It may, however, be doubted if typhoid is caused by impure milk, for the women and children who consume more milk than the men, do not suffer much from this disease. A scorbutic taint is common, often regarded as malarious cachexia. This should be guarded against by a double ration of green vegetables whenever possible, for a scorbutic taint paves the way for fever.

It has been asserted that malarious fever may arise from drinking impure water. Whether this is correct or not, the old leathern "mussack" should be abolished from every barrack, as it has been from most; for, however pure the supply may be at the source, water is rendered impure by the mussack. Quinine or arsenic should be taken as a prophylactic during the feverish months. The jurisdiction of the military commandant and of his cantonment magistrate does not extend beyond the cantonment limits. He should have control, through the

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* A cloth worn by the natives round the loins and bowels.

† Natives never eat if they can avoid it in the heat of the day, and those who use meat take less of it in the hot season. They also pay great attention to the state of the bowels, which is constantly neglected by Europeans.

‡ This is emphasised when it is recollected to what purpose the left hand of the native is applied.

cantonment magistrate, for at least two miles, over every village and bazaar. Especial control is necessary as respects the beverages sold in the bazaars.*

All the above is to be accomplished by authority, but classes for instruction in hygiene should be formed in every regiment or station. Men and officers should be taught how to take care of themselves. They should be taught the danger of unnecessary exposure to the sun, and to take the greatest care to protect the body from comparative cold and damp, which, especially in the form of colder night airs, dew, drenching rain, and sudden diurnal and seasonal changes of temperature, acting on a skin much excited and consequently debilitated by heat and perspiration, constitutes, if not the dreaded malaria itself, an agency quite as injurious.† They should also be taught that eating too much meat is likely to excite a plethoric, feverish state; that sleeping after a heavy meal, as many soldiers do, is detrimental to health, and that intemperance is generally a short road to the grave.‡

Lastly, I think the station hospital system is a mistake. The soldier, and especially the young soldier, should have the medical officer's eyes constantly upon him. And this is not possible unless there are regimental medical officers. In India early attention to slight ailment is required. An attack of fever may often be prevented. But soldiers will not apply to station hospitals with the freedom they do to a regimental one.

With reference to the general population, much of the foregoing is applicable. But more extended operations are required. The principal heads are subsoil drainage, for whenever water approaches a certain distance from the surface it generates damp. What is required in most localities is a lowering of the water level, and aeration of the soil round habitations. There are, however, some exceptions.§ Secondly, surface

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* There is also another important point, viz., the prevention of venereal disease. Recently the House of Commons decided against the continued operation of the Contagious Disease Act in India, and venereal disease has, therefore, much increased. A large amount of the fevers European soldiers suffer from in India is either much aggravated by the syphilitic taint, or is purely syphilitic, and this may assume an intermittent, remittent, or continued form. Similarly much of the liver disease originates from syphilis.

† Fever occurs at places and seasons free from all suspicion of malaria, and it has not been proved that appearances sometimes found in the blood of persons suffering from so-called malarious disease are introduced from without.

‡ Very recently the Military Medical Department issued a circular, giving plain instructions how to preserve health in India, which every soldier should be acquainted with, and should be made to thoroughly understand.

§ Such are the sandy, semi-desert districts of Western Rajpootana, where water is several hundred feet from the surface. Yet, notwithstanding this, and a very scanty rainfall, the sand is always damp a short distance below the surface, and this would not be obviated by subsoil drains. Sand is also hot by day and cold by night, thus exposing the people to great vicissitudes of temperature, and in this fact I suggest an explanation of the prevalence of fever in the semi-desert

drainage for the rapid removal of storm water by impervious conduits is required everywhere. In the extensive tracts of lands irrigated by raised canals* the problem has yet to be solved how efficient irrigation is to be combined with effective drainage. It is well known that irrigation in some districts has raised the level of the water in the wells, and rendered ground and habitations damp, which were previously dry; the consequence being much fever, often accompanied by pneumonia. When roads or railways are carried through the country greater care should be taken, by the plentiful formation of culverts, that they do not act as artificial dams. Digging deep tanks in marshy localities, and raising the surrounding surface with the earth, which then forms good cultivatible ground, has been productive of much benefit. The cultivation of the eucalyptus and of the sun-flower has not been successful.

A pure water supply is a *sine quâ non.* Much has been done in this direction where the physical features of the country are favourable for storage. But much remains to be accomplished. Where physical features are not favourable, water should be conveyed by pipes from distant wells. Equalisation of the food-supply throughout the country has been much favoured by railways and new roads. Formerly one district might be famine-stricken while plenty reigned in the next, because there were no means of conveying food. For there was neither grass nor water for beasts of burden. Nothing conduces more to fever in India than insufficient food.†

There is also another important consideration. In the most feverish districts of India opium is used extensively as a prophylactic, and, as I believe, with good reason. It has been recently proposed to limit the use of opium to physicians' prescriptions. If this were done, I think the amount of fever among the poorer population would be alarmingly increased.

The principal causes of fever among the natives of India are to be found in a teeming population working hard, and living scant, residing in ill-ventilated buildings, more or less destitute of drainage, and therefore damp, exposed to great solar heat and to wide diurnal and seasonal changes of temperature. Also in various unhealthy habits and customs. Among these are want of cleanliness in houses; washing in their houses on an earthern floor; washing in the open air, perhaps in a cold wind; sleeping on the ground; garments not sufficient to protect them from

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districts of India. Surgeon-General Cornish has noted the inapplicability of subsoil drainage to certain military stations in the Carnatic, where they suffer, not from too much moisture, but from excessive dryness of soil, and where during prolonged periods of drought subsoil pipes become blocked by deposits of ants, lizards, rats, &c., so that when they are really required no water flows.

* There are in British India 18,135 miles of irrigation canals, irrigating 12,098,000 acres.

† In connexion with food, salt should be mentioned. An increase of the salt duty lessened the consumption in 1888–89 considerably. The necessity of salt as an article of diet cannot be questioned, and it should be made as cheap as possible. From observation I think insufficient salt renders the person more liable to fever.

changes of temperature, especially during the monsoon. Such habits must be abandoned, and the bulk of the people must have more food,* better dwellings, more suitable clothing, and some knowledge of hygiene, before we can hope for a material reduction of Indian fevers.

In the hands of microscopists and scientists, the tendency of the times is to refer fever, in common with many other maladies, to the operations of bacilli† or of microbes introduced from without. But it cannot be denied, that the febrile condition may arise from exposure to cold, from exposure to great heat, or to the sun, from digestive derangements, from fatigue, and from mental emotions. All admit that secondary attacks of so-called malarious fever present, without any fresh exposure to malaria. And there are such maladies as rheumatic fever, traumatic fever without external wound, and, according to certain authorities, endogenetic puerperal fever. It seems reasonable to place fevers in the category of diseases the causes of which are formed within us; probably by the retention of excreta in the system, or by the imperfect transformation of tissue into normal excreta, under the influence of chill‡, fatigue, damp, overcrowding, scanty food, and various other causes. But even admitting that the *bacillus malariæ* and other microbes cause fevers, it must also be allowed that they are, more frequently than not, destroyed by that *vis medicatrix naturæ*, which one of the latest theories regards as devouring cells (phagocytes). For microbes exist everywhere in nature, and according to the champions of the *bacillus malariæ*, it is *produced* in every so-called malarious country. We inspire and swallow microbes and bacilli in countless millions. I do not therefore consider that the prevention of fevers is to be accomplished by searching for germs, or by undertaking the futile task of endeavouring to prevent their entrance into the atmosphere and

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* There is also a prevalent underlying scorbutic condition, often latent, which renders the people more liable to fever.

† With reference to the *bacillus malariæ*, it appears to have been forgotten that malarious disease has prevailed on every variety of ground surface, even on bare rock. It is scarcely reasonable to presume that all kinds of soil produce this, bacillus. In the semi-desert districts of India where the surface is sand, and the under-stratum sandstone; where there are no marshes and little vegetation; where there are no rivers; where the rainfall does not exceed five or six inches annually; and where water is hundreds of feet from the surface, malarious fevers are as prevalent as in the Concan, where the surface is black soil, where marshes abound where vegetation is most luxuriant, where numerous rivers flow, where there may be 100 inches of rain, and where water is three or four feet from the surface.

‡ Dr. Moir, I.M.S. has recently stated the case thus. (Ind. Med. Gaz. Feb. 91). "The difference between the chill theory, and the specific micro-organism "theory is analagous to the difference between primary and secondary causes." The bacillus or some chemical product being the primary cause, exposure to chill, or to heat, or fatigue, being the secondary cause. This entails the belief that the organisms or their products lie dormant in the system until some change or excitement in the circulation liberates them. But I hold that chill, depression, fatigue, want, are sufficient to excite fever from a common cold to an ague fit or a remittent, especially in a tropical country, and in certain constitutions and temperaments.

bodily system*. The prevention of fever depends much more on strengthening the *vis medicatrix naturæ* by the various means I have named, than on any other measure. Every energy should be applied to the progress of general sanitation, to the diffusion of a knowledge of personal hygiene, and to the dispersion of the ignorance, fatalism, and caste prejudices of the majority of the natives of India, now so opposed to public health, and there would certainly be much less fever in that country. Although Government can and does insist on a large amount of outside sanitation, the State cannot interfere directly in the ordinary internal daily life of the people. I have not time to describe the lamentable insanitary interior of a native house, nor further to dilate on the habits of the people. But I feel sure, that with material and moral progress, there will be sanitary progress, and with sanitary progress fevers will diminish. Whether Indian fevers are due to paludal or telluric emanations, or to chill, or to both, all directions for their prevention tend to increase dryness of the climate, and thus to lessen the sources of chill; or by clothing, nourishing food, avoidance of fatigue, and quinine, to prevent its operation.

In conclusion I attach some extracts showing that these views which I have long expressed are receiving more general acceptance, malaria especially being relegated to the back-ground.

In the memorandum of the Army Sanitary Commission for 1880, on the report of the sanitary officer for the Berars, it is stated, "The "fever deaths in the rainy period exceeded by a third the number in "the dry period. Temperature fell with the advent of rain, so that "this last element was the real cause apparently of the increase of "fever."

Dr. Little, the Sanitary Commissioner for the Berars, still more recently says, "Chill and insufficient clothing are the great factors in "its production . . . . . a damp soil, with alterations of "temperature, causing increased evaporation, with day and night fluc-"tuations of heat and cold, and consequently chill." Another sanitary officer remarks, "The natives of India in their cotton garments are "exposed to rapid alternations of temperature, especially during the "monsoon months. If they had flannel socks, shoes, warm clothing, and charpais to sleep upon, malaria would disappear." In a very recent annual report of the Sanitary Commissioner for Madras (Brigade-Surgeon Laing) it is stated, "There is no doubt that much of the fever "is due to the habits of the people." Dr. Gregg, Sanitary Commissioner for Bengal, remarks on "the poor people who for the most part "sleep on the ground, wear wet and insufficient clothing, and drink "impure water." Another official observes, "the one great cause of "fever throughout India is the existence of dampness on, and in, an

* Klebs, the father of the *bacillus malariæ* could suggest no better preventive means than covering the surface of the ground with some impervious material, in order to prevent the bacilli ascending into the atmosphere, which is manifestly impracticable over a large area.

" impure and foul surface and subsoil in inhabited areas." Dr. Weir, the health officer for Bombay, has quite recently remarked, " It is note-" worthy that the increased mortality from fevers is chiefly in the " suburbs, and in districts where population has rapidly advanced, and " where the advance of population has been greater than the advance " of works and channels to carry away the moisture."

Some years back Syed Abdoollah published observations, " On the " cause and prevention of fever in India." The author described the ordinary native dwellings in Indian towns, the badly ventilated and lighted yards and rooms, and absolute absence of drainage, the foul waste-water of houses either discharged into a side gutter and then allowed to evaporate, or where no such gutter exists, discharged into an earthen jar sunk at the side of the lane or street, and occasionally emptied on the nearest dunghill. Sometimes a hole dug in the side of the street is the receptacle of liquid refuse, while the contents of the masonry cesspools in the more wealthy natives' houses are, when full, thrown out indiscriminately over the thoroughfares to be absorbed or to evaporate. " Were it not for carrion crows, hungry pariah dogs, swine, and other " creatures which perform the office of scavengers, and for the extreme " dryness of the air, human life could scarcely be maintained under " such pestilent conditions. The nature and management of the water-" supply is moreover a lamentably active cause of disease throughout " India." Syed Abdoollah considers that " the immediate cause of fever " is to be sought for in the dirt, poverty, and over-crowded condition " of the villages and towns, the filthy and unventilated state of the " dwellings; the close confined air of the dense jungles; and the " presence in the rainy season of large quantities of stagnant water " and decaying vegetable matter." In conclusion the author points out that free ventilation, scrupulous cleanliness, wholesome food, proper clothing, and abundant fuel, are matters which cannot be too strictly attended to, while the daily use of warm baths and the wearing of flannel are also considered safeguards against fever.

Mr. Stanley, at p. 31, Vol. 2. of " Darkest Africa," states that when they travelled through the forest region they suffered less from fever than in the open country. But a halt in the forest clearings reminded them they were not acclimated. On the plateau of Kavali, 4,500 feet high, there was much fever. When facing the wind on the Congo they were smitten with fever. Also when meeting the wind on the Aruwini. Yet notwithstanding all these facts, which tend to demonstate that exposure to the wind and consequent chill is the cause of fever, Stanley goes on to say, " Hence we may infer that trees, tall " shrubbery, a high wall, or close screen interposed between the dwel-" ling place and the wind currents, will mitigate their *malarial* in-" fluence." The fact being that such obstacles mitigate the fall of temperature caused by moving air.

Sanitation in India.

BY

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There is no country that requires greater attention to be paid to sanitary measures than India, and there is, probably, no country which will repay the labours of the sanitarian better than India, as is already shown by the results accruing from the prosecution of sanitary works and the adoption of sanitary measures which have, wherever introduced, been immediately followed by a marked improvement in the state of public health.

The supply of wholesome water, the construction of sewerage and drainage works, and an effectual and safe method of dealing with the waste products of the vast populations are matters of urgent necessity throughout India. The general habits of the majority of the native population are such as to lead to the pollution of the air, the ground, and all unprotected sources of water-supply.

The dense population living in Indian cities—a density which is in excess of that in any European country—is a condition that points to the urgent necessity of efficient sanitary measures being adopted. There is no wonder that the death-rates in Indian cities are large, as the average density of population may be taken as 100 persons per acre, and in many parts of the cities there is still a greater congestion of the population.

Under existing arrangements the ground of all Indian cities is more or less impregnated with filth and the urinary excretions of man and beast, and so great is this pollution that in most cities local wells have become brackish as a result of ground pollution. Nor is this state of things confined to the cities, for in the villages there is just as great neglect of sanitary requirements, and the cattle often occupy the lower rooms of the habitation, thus adding to the unhealthiness of the dwelling and the pollution of the ground.

The inhabitants of the cities, towns, and villages in India, die of diseases arising from insanitary conditions at a rate of which we have no conception in this country. There are also other causes of death in India (some of which are common to other countries) that influence the death-rate, such as exposure and insufficient clothing during the wet and cold seasons. The natives of some parts of India are also subject to causes of deaths unknown in European countries, such as death from snake-bite, and being killed by wild beasts, but deaths from these causes may be excluded, as they are less than half per cent. of the total deaths in the district most subject to this form of mortality.

The climatic conditions of India cannot be considered absolutely unfavourable to the promotion of good health. The high temperature

of the plains of India, having regard to the polluted state of the ground and of the water-supplies, is a condition certainly not favourable to the health of its inhabitants. On the other hand, probably, if it were not for the influence of the sun in drying up and destroying much of the polluting matter, the health of the inhabitants of India might be much worse. The most unhealthy periods in India are certainly not the hottest periods of the year. The high temperature of the ground is unfavourable to health in all those places in which the refuse from the population is stored in receptacles below the ground level. The favourable health statistics of large towns like Bombay and Calcutta show that it is not climate that causes the frightful mortality in many parts of India, but that this is due to the downright neglect of the simplest sanitary precautions.

The fixed wet and dry seasons of most parts of India can be depended upon with a degree of certainty. The excessive rainfalls of one period, compared with the long absence of rainfall in other periods, tend to show that the separate system of sewerage is one which is the most proper for certain places in India, and that the rainfall in these districts should, as far as possible, be completely segregated from the sewage proper. The rainfalls in some of the larger cities are excessive, for in Bombay falls exceeding 4 inches per hour have been recorded, while in a single day over 16 inches of rain have fallen. The average of the heavy falls of rain in Bombay exceeds 2 inches per hour, whilst the average of the daily heavy falls exceeds 7 inches per day. In Calcutta, the rains are not so heavy as in Bombay, but occasionally heavy falls exceeding the rate of 3 inches per hour have been recorded, but on an average rainfalls exceeding 5 inches per day are only recorded once in three years.

The sanitary appliances in use in India are of an extremely varied character. In many cases conservancy is unknown, and the refuse of the population rots at each man's door. In the cities, for the most part, the Halalcore system is adopted, a system by which the solid nightsoil is collected in a basket placed below the closet seat, an arrangement which allows the liquid parts, including the water of ablution, to flow away, usually to the street gutters. Under this system the stercoraceous matters are collected by men and women every day and then carried in baskets on their heads to some central point where they are deposited in a barrel on wheels and are then carted to some place for disposal. In the cities where they have sewers, these matters are mixed with water and flushed into the sewers; where they have not sewers, the matters are either trenched or buried in the ground or manufactured into poudrette.

The trenching of nightsoil cannot go on in the time of the monsoon, and at this period the material is generally buried in deep pits, to be sometimes resuscitated and manufactured into poudrette. As a rule, the effect of burying this matter in deep pits in the hot soil of India causes a violent fermentation to take place, and an indescribable nuisance to be created. The trenching grounds, too, are extremely obnoxious, and the position of these trenching grounds is ordinarily fixed as a matter of

convenience, and often pollutes the underground water, the soil, and the atmosphere of the neighbourhood of a town to a most injurious extent. At Poonah an attempt has been made to manufacture the material into poudrette by admixture with wood ashes and drying in the sun, and under sheds in the monsoon; and it is found that a manure very valuable for some crops can be produced, but that the sale of the manufactured article does not return more than one half of the cost of its collection and manufacture.

In most cities privies are of common occurrence, and the author has seen a structure of this kind in Calcutta, in which the excreta drops into the basement of a many-storeyed building of considerable altitude, where it accumulates to a considerable depth and from whence it is removed in semi-liquid condition by the Sanitary Department. Cesspools constructed in brick, stone, and other materials are in common use, and large earthenware jars sunk into the ground are also used as cesspools, and are emptied at periods more or less remote. The surface of the street in most cities is the receptacle for a large part of the sewage of every city.

In the Holy City of Benares they have had a system of covered sewers in operation for a long period, but these sewers are more or less imperfect in form; yet, bad as they are, Benares is in a much better state of health and has had a lower death-rate than many of the towns that do not possess any such system; and this, in face of the fact that Benares is the home of large numbers of persons who go there especially to die, and is a very crowded city, is a matter that speaks well for the advantages of works of sewerage.

Earth-closets also have been used in India, but it is found that owing to the large amount of earth required their use among natives is not general, as the waters used for ablution necessitate about 5 lbs. weight of earth being used to each inhabitant per day.

With the exception of some of the large cities, the water-supplies are extremely defective. The supplies are usually taken from tanks which are, for the most part, nothing but filthy polluted ponds to which generally the drainage of the village or town has direct access. The tanks in use in the suburbs of Calcutta may be taken as a fair description of those ordinarily used throughout India. Analyses of the water of these tanks show that by far the largest portion of them might naturally be classed as containing raw sewage.

As an example of the polluted state of the tanks, and of the effects of often filling them in with vegetable and animal refuse, Dr. Simpson, the medical officer of Calcutta, gives a very interesting example in one of his recent annual reports as to the state of these tanks after being partially filled up. A woman residing on the banks of one of these tanks in Shampooker lit a fire for cooking purposes, but after the fuel was consumed the fire continued to burn with a continuous flame, and she was able to cook her food every day for more than a fortnight without being put to the expense of buying fuel. She kept the secret for some days, but at last told her neighbours, who were invited to come and see the wonderful light. Her visitors, however, became so numerous that

she made a charge of a pice per head, and by this means, in one day, she realised no less than four rupees. It was a matter of great astonishment, the flame being looked upon by her visitors as the tongue and breath of the devil. The income of the woman was, however, stopped by some of the inquisitive visitors digging up the ground around the house and so allowing the gases of decomposition to escape, after which the fire went out, or only burned fitfully.

The supply of water from wells also is largely in use. The water of all wells within Indian cities must be looked upon with suspicion, as all these supplies are liable to pollution, and in many instances they have become so polluted that they can be no longer classed as fresh water. The wells also, in a very great measure, are liable to pollution from the mode in which the water is drawn by the utensils of each individual using the water, and also by reason of the site of the well often being used for the purpose both of ablution and washing of clothes, and the liability of the polluted waters to return to the well. The running streams of India, to which the natives have access, are polluted from their very sources downwards; but, as a rule, the districts supplied from running streams are healthier than those drawing their water-supplies from either tanks or wells.

Cholera, which is more or less prevalent in many parts of India, is almost entirely due to the defilement of wells, tanks, and rivers. The consuming thirst of the cholera patient leads directly to the speedy contamination of all unprotected water-supplies. This has been shown in the enormous reduction of cholera in Calcutta by the introduction of the public water-supply into that place, and even the recent extension of Calcutta water-supply to some of the suburbs of Calcutta has produced an immediate and enormous diminution in the deaths accruing from this very fatal disease.

The experience in India in connexion with water-supplies taken from rivers shows that the rivers undergo a process of purification, and that the waters taken from them, after a sufficient length of flow, and if perfectly filtered, are among the most wholesome supplies in the country, as the case of Calcutta fully demonstrates. There is also abundant experience that the introduction of water into a district will not of itself promote good health, especially if the water supply is taken from a place liable to immediate pollution; for example, the city of Ahmedabad until the present year has had waterworks, the source of the supply being the Sabarmati River, the intake of the works being actually located within and at the lowest part of the city, below all the points where the river is used for ablution, washing, and other purposes, and is liable to receive the filth of the city washed in with the rains in the monsoon period. Under such a state of things, and in the absence of proper sewerage, Ahmedabad has been very unhealthy, the death-rate of its people having, at times, exceeded 70 per 1,000; and on an average of 11 years—1875 to 1885—it has had a death-rate of 53·15 per 1,000. This state of things at Ahmedabad has just been remedied by moving the intake of the waterworks to a point in the river above the city.

In the city of Poona there is also a water-supply, but no sewerage; and this city, which is much more healthy than most cities in India, does not enjoy that high standard of health which is secured in cities which have both drainage and water supply. For some time it was a question of doubt in India whether or not, owing to the peculiar religious tenets of some of its inhabitants, they could use water which had been filtered and supplied through pipes. However, it appears that the Brahmins have announced that filtered water brought through pipes can be used for all purposes except religious ceremonies.

The quantity of water used in the cities of India would be extremely large, under existing arrangements, if the supplies were constant, as generally the native has cleanly habits, and will not bathe in his own house in water in which anyone else has previously bathed, and, as a rule, water is continuously running to waste all the time he is taking a bath. This habit contrasts strangely with the filthy habits of bathing when using the polluted water of tanks or rivers in common with others.

In Calcutta the intermittent water-supply of 14 hours per day is over 44 gallons per head per day, and in Bombay it is over 20 gallons per head per day; and it is very questionable if the waterworks which are now being carried out in India will afford a sufficient supply of water for the demands of the population, having regard to the way in which the water is used when once introduced into the city. It is imperative, therefore, in all waterworks, that such water fittings shall be adopted as will prevent the waste of water.

The sanitary appliances for the removal of the refuse of the population by water carriage in India must not only prevent the waste of water, but must be of such a character as not to even splash with water the person using them for fear he is polluted; yet these same natives ordinarily bathe in common, and use waters for all purposes of the vilest character, to which there has been access of all those matters which are looked upon as a cause of pollution to the particular individual when he has to use sanitary appliances within his own residence.

Such is the sanitary state of India, that it is recorded that in the North-West Provinces alone, according to the authority of Dr. Hutchinson, the Sanitary Commissioner, that in 40 out of 106 towns in the year 1889 the deaths exceeded the births. He mentions that the rate of mortality in the small town of Lalitpur, which had a population in 1881 of 10,614 persons, was 81·48 per 1,000, of which 27·32 per 1,000 was due to deaths from cholera.

Small-pox also not infrequently produces a very high death-rate in the districts in which vaccination has been neglected, and in the town of Sandila, containing in 1881 a population of 14,865, the death-rate from small-pox alone, in 1889, was 17·02 per 1,000.

The deaths from fever in India have a different signification as compared with England, for in some places nearly the whole of the mortality is ascribed to fever. This is due to the imperfect system of the registration of deaths, as most authorities in India agree that in all probability the actual mortality from fever does not exceed 25 per cent. of the total

deaths. The general cause of death, except in the case of cholera and small-pox, is not distinguished by the native collector of statistics, and consequently every disease in which there have been feverish symptoms is usually put down to fever. As an illustration, in Cawnpore, the death-rate from fever is stated to be 39·92 per 1,000 of the population, whereas the death-rate from all causes stands at 49·60. The city of Cawnpore, in the year ending March 1890, had a death-rate of 53·11 and a birth-rate of 40·46. It should be noted that in India very many deaths are not recorded, so that the death-rates in all cases may be taken as being higher than is actually given by the figures.

As a rule, the towns in India are very much more unhealthy than the districts in which they are located. In the North-West Provinces the average death-rates of all the towns exceeded, on an average, during the past five years, that of the districts in which they are located by 5·13 per 1,000. It is also found that women, who are more exposed to the insanitary conditions of home life, suffer more than the males. Dr. Simpson's returns for Calcutta show that the deaths of males for four years, from 1886 to 1889, was 23·4 per 1,000, whilst it is found that the deaths of females in the same time was 31·4, or the female rate of mortality was 36·5 per cent. greater than that of the males. It should also be noted, especially with regard to the position which females occupy in India, that the suicides amongst females are three to one of the males, or exactly in the reverse proportion to that of England. This is, in a great measure, attributed to the restraint put upon females.

As a result of sanitary work in the case of the city of Calcutta, we have the means of comparing the health of that city, which receives a good supply of wholesome water, and has been sewered, with that of the suburbs, which have received neither of these advantages. From Dr. Simpson's return for the 12 years 1877–1888 it is found that the average death-rate of the city of Calcutta was 28·7 per 1,000. In the same 12 years the average death-rate in the suburbs of Calcutta was 47·25 per 1,000. The population was almost twice as numerous in Calcutta as in the outside district, yet the outside district had an average death-rate exceeding that of the city itself by 64·63 per cent. These figures at once show the incalculable advantage to any place adopting sanitary measures, for it cannot be said that in Calcutta the sanitary works, as regards its system of sewerage, are by any means perfect, and nearly the whole of the benefits which have accrued in the case of Calcutta has been shown to be due to the introduction of a wholesome supply of water; and this may again be inferred from the fact that in the suburbs of Calcutta that have been supplied with wholesome water and have no sewerage works, the death-rates have immediately been reduced. Moreover, it was found that when Calcutta was first supplied with water in 1876, before its sewerage works were carried out, the average death-rate for five years, before the supply was introduced, was 38·2 per 1,000, while the average death-rate for the subsequent five years was 24·6 per 1,000, or a reduction in the death-rate of 35·6 per cent. The authorities in India usually calculate that for every death recorded there are at least 20 cases of sickness. In all probability the number may

stand much higher, as by reference to the report of the Commissioners at Poona, I find that in the year 1885, out of a population of 100,000 persons, it is recorded that 51,842 were admitted to the hospitals in this city in one year.

Investigation of the sanitary state of India shows the urgent necessity that exists for sanitary measures, and it is gratifying to know that the Sanitary Commissioners of India are fully alive to the advantages of such measures, and, aided as they are by the supreme authority and by the Governments of the various provinces, it is hoped that in the course of a few years much will be done to mitigate the evils arising from the insanitary state of the large towns and of the country generally.

The Water-Supply of India.

BY

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The vast importance of the general subject of the water-supply is so fully admitted in the present day that no outlay is deemed extravagant or excessive when the object of it is to secure this first necessity of sanitation. When cities such as Glasgow, Liverpool, &c., in search of this source of health, enter on schemes such as that completed for Glasgow, and that now being carried out for Liverpool, the extent and cost of which it is difficult to realise, it is yet felt that on this one important point a primary judicious liberal outlay is, in the end, the most economical; and perhaps nowhere is this more evident than in the case of cities like Glasgow, Cardiff, Liverpool, &c., which are also large seaports, and where the value of a really good water supply can never be over-estimated, as it is greatly to be feared that much of the sickness experienced on board ship is due, not a little, to the inferior quality of the water taken in at the port of departure being such as to make it unfit for storage.

If all this is necessary in this country, how much more is it so in India, with its population, practically total-abstaining, proverbially like their sacred cows indifferent either to the source or quality of their drinking water, so dense and so migratory. And yet, if the question were asked, What has been done in the matter of the water-supply of India? up to within the last 10 years I fear the answer must be, Practically nothing. True, within these 10 years considerable efforts have been made to improve the water supply of large cities, such as Calcutta, Bombay, &c., but the population of India is not to be found in the cities; 95 per cent. of the people of India are in the villages, and

what, I ask, has been done for them? And again the answer is, Nothing, if I may judge from an experience as extensive as that enjoyed by most medical officers of 30 years' Indian service. Take, for instance, the densely populated districts of the upper portion of the Mesopotamia, of the Ganges and Jumna, as embraced in the Agra and Meerut Divisions; or the first sanitary circle of the North-Western Provinces, with a population of over 10,000,000, crowded together to the extent of over 500 to the square mile. For 20 years continuously I was in the sanitary charge of this circle from 1864, and I can vouch for it that nothing has been done by the Sanitary Department with the Government of India during that time to improve the water supply of this circle, and I challenge them to say that it is due to my neglect in failing to bring the subject before them. My annual sanitary reports will answer this, and will further show that the remedies I proposed were not such as would involve a large outlay, but were cheap, simple, and permanent. Not only has nothing been done for the fixed population of these districts, but that most important section, as regards the public health of the community, I mean the migratory and pilgrim population, has also been left worse than unprovided for in the matter of its water supply, as wells which should be closed are left open to tempt the thirsty traveller to his fate, and a regiment on the line of march, when halting for its early breakfast, as I know, ran a great risk of having the seeds of typhoid fever taken up from one of these wells containing, not only stagnant water, but water charged with malarial germs. Through the whole length of this district pass tens of thousands on their way to and from the sacred shrines of Muttra, Bindrabun, &c., and places of pilgrimage on the Ganges and Jumna, from Hurdwar to Allahabad on the former, and from Kalsi (where the Jumna leaves the Himalayas) to the union of the latter with the former, at "Pryag" or Allahabad. The condition of the water in the wells and their surroundings are a disgrace to sanitation from the "Meeta Kooah," the sweet well at Agra, to the filthy well near the sacred steps at Hurdwar. The same, alas, is the case with the wells on the line of railway, with stations such as Etawah, Toondlah, Agra, Gazeeabad, and Saharanpur. Can it, therefore, be a matter of surprise to hear that that country is decimated by sickness, in a great measure preventable. To sum up this terrible account, I have seen the water in the railway well at Saharanpur fouled by "lotahs" (the brass drinking cups a native carries over his shoulder with a cord) covered with unutterable impurities during an epidemic of cholera, and a regiment passed through the station under these conditions. I can point to roadside and encampment wells in which the water was impure from stagnation, and the imperfect way in which the well was emptied in the case of troops coming to encamp on the spot, by which the impurities adhering to the sides of the well were left to be again mixed with the water as it rose in the well. It is from sources such as these that typhoid fever enters the large military cantonments, where, from the defective water supply, it soon spreads, and an unaccountable (?) outbreak of typhoid is the result.

The water-supply of the plains of India, as met with in the Bengal Presidency, may be classed (that from artesian wells being still under trial) under three heads, viz., Well, River, and Tank or Pond water.

Well-water.—The quality of the water from this source varies greatly, from the perfect supply, obtained by the presence of a faultless masonry tube, which brings the water to the surface after a *compulsory filtration*, through suitable soils, where by constant emptying and refilling and the absence of several feet of leaf mould at the foot of the well, owing to the well being covered, the water is, for all practical purposes, as perfect as can be obtained in the plains of India, to the filthy water obtained from wells which are but slightly removed in the rains from cesspools, as is the case with some of the servants' wells in the officers' compounds in the cantonment of Meerut. Between these two extremes as regards quality the well water of the plains of India ranges.

The ideal well I have described is, I fear, far from common in all the conditions necessary to secure a good water-supply; and there is little doubt that the drinking water for the vast majority of the peoples of India, as far as it relates to well-water, is obtained from the most defective system of wells; and it is because I feel that the real sanitary improvement of India must begin at the well, that I have asked to be allowed to draw special attention to it.

Let me start with the village well, or that from which nine-tenths of the population of India draw their drinking water. This is nearly always "kutcha," *i.e.*, dug out of the soil, without any masonry tube, the home, too often, of pigeons and other birds, as a protection from cats and snakes, with but rarely any parapet, and generally a "peepul" (sacred fig) tree over it, whose dead leaves have produced a layer of leaf mould, it may be two or more feet thick, rarely cleaned out except when something valuable falls into the well. Can it be wondered at that malarial germs suspended in this water, and forced through this mould by spring-water-power, are freely drunk by these villagers, to say nothing of the impurities washed in owing to the absence of a parapet, or the young birds falling in from their nests. There is only one source of impurity from which these "kutcha" wells are free, and which in "pucca" or masonry wells is often the cause of the water becoming unfit for drinking purposes; I allude to frogs. These animals, if they have nothing to rest on or hold on to in the well, not infrequently die. In a "kutcha" well they manage to rest in little holes in the sides, but in a "pucca" one the natives always throw in some "bajra" or millet stalks when they see there are frogs in a masonry well, and nothing on which they can rest. In most villages there are generally one or more masonry wells, but the surroundings, as I shall point out, are such as seriously to interefere with the purity of the water. These wells however, are in the enclosures of the head man of the village, and are, therefore, not available to all. There is always a tree shading these wells, and, unless the masonry sides are in good condition, the impurities of the courtyard too often find their way, little changed, into the water in the

well by means of the roots of the tree and cracks in the masonry. Near this well often is a most insanitary institution known as a "chawbatcha," which is simply an open receptacle for all kinds of surface impurities, and as this is frequently near the verandah, we cease to wonder how it is possible to become quite indifferent to that which would upset most people. Not a few of these wells are so constructed that a passer-by can dip in his "lotah" and draw up water, but after what I have said of the too frequent state of this "lotah," this must be a dangerous proceeding to the health of the household. In short, it seems almost hopeless under present conditions for the water in a town or city well to be pure, unless situated within an enclosure; but here a fresh difficulty arises, water in India under the ordinary conditions met with in even a fairly good masonry well, cannot remain pure unless regularly withdrawn, and as this is impossible in the case of a large well and a small household, the result too often is that a species of typho-malarial fever breaks out; it may be confined to a house or two, but if the season is unusually dry, the disease sometimes becomes alarmingly epidemic, as happened once at Haupper in the Meerut district. The remedy for this lies in using the water for irrigating the garden, and if this is impracticable then in obtaining drinking water from a well constantly in use.

River-water.—In the plains of India, when we think how little makes a river even temporarily sacred, viz., by its running southward, and when this is the case, how it becomes the highway to heaven for the mortal remains of all who can secure this last religious act being performed, I think it requires very little sanitary knowledge to decide that, with but very rare exceptions, it is, unless a most elaborate and careful system of purification is secured, a most hazardous proceeding to use river water in India for a drinking-water supply; and nothing would induce me to use it for this purpose without boiling it first.

Tank or pond water.—This is open, if possible, to greater objections than the river water-supply, because there is no real change taking place in the water, and if bodies are not thrown into it, there is little doubt that many corresponding impurities find their way into these ponds. Some species of water plants are credited in Bengal with purifying the water of ponds; possibly they may, but I prefer 212° Fahr.

Filters at railway stations as a means of purifying the water require so much looking after, that I prefer the plan recommended hereafter. The filter at the cantonment railway station at Meerut, when I once inspected it by lifting off the cover, only required the regimental band to convert it into an object for an aquarium, and if this happened at Meerut, what may we not expect at smaller stations.

In some parts of India, where the water-supply is apt to become very impure from the heavy rains, the rain-water is collected and carefully stored in large jars. The mode of this collection is as effective as it is simple, viz., by means of a very large cotton sheet, tied at the four corners to poles, about four feet high, and to secure the collection of all the rainfall a smooth clean stone is thrown on the sheet, and as it rolls

into the centre and remains there, the water gathers here, and passes into the collecting jar below. This, when full, is taken away and emptied into the large storage jars; thus, a supply of very pure water is obtained, and when carefully stored in a cool place, is no doubt in many districts very valuable.

After this practically universal condemnation of all the ordinary sources of the water supply, as at present met with in India, the least I can do is to recommend some measures for securing a good water supply, if such are practicable; and fortunately they are not only practicable, but simple and feasible. During my entire Indian service the improvement of the water-supply was my constant endeavour, and with, I trust, justifiable pride and satisfaction I can point to that at the hill sanatorium of Mussooree in the Himalayas, as the crowning of all my labours, for here is a water-supply, perennial and incapable of pollution, delivered at three different parts of the sanatorium, and all attained without the addition of a penny to the amount of the local taxation. This entire scheme was carried out quite independently of the Sanitary Department with the Government of India, for, as an elected not officially nominated member of the Municipality of Mussooree, I designed and superintended the whole scheme; and to this municipality is due the entire credit of having a water-supply unequalled in any other station in India, on the hills or in the plains, at an entire cost of Rs. 30,000, or about 3,000*l.*, spread over six years.

At my first station in Orissa, in 1855, by using the ordinary baked clay rings, I sunk new wells where I found the locality of the old ones defective; and when I came to the North-Western Provinces in the special Sanitary Department, I saw from some cases of typhoid fever at Mussooree the absolute necessity of a good water-supply, and that scheme just alluded to was the outcome of these cases of typhoid fever. When marching through the first sanitary circle in 1864, I saw the condition in which the supply of drinking water for the troops on that line of march and for the weary traveller or pilgrim was in the roadside wells, and in those in the encamping grounds, and after various trials and experiments, decided on one which seemed cheap, simple, and effective. When the railway system spread through my circle, I felt that, unless some steps were taken, the water at the railway stations would prove a serious source of danger to the public health, and accordingly I suggested the following measures for remedying the defects complained of.

First.—Roadside wells. In my circle there were about 200 of the "cos kooahs," or two-mile wells, and the simple plan I suggested was to let out these wells to the cultivators of the fields near, on the single condition that the water, before it passed into the irrigation channels, should fill a trough for the cattle, and also admit of a lotah being filled as the water came fresh from the well. Where this was carried out, it answered admirably, and cost the Government nothing; but the Sanitary Department paid no attention to the suggestion at the time, and who can tell how much of the present typhoid prevalence in the North-Western Provinces and Oudh is due to this indifference?

Second.—Wells in encamping grounds. My suggestions, similar to the above, were carried out by some magistrates, and appeared to work so well that one wonders how the system was not universally adopted. While on the subject of water-supply when in camp, I think my experience of this is as varied and extensive as that of most medical officers, and perhaps the following may prove useful. As a rule, when in camp, I generally obtained my drinking water from an irrigation well *at a distance from* the village, preferring this to the water from the well in the encampment. From these irrigation wells the water was not only fresh and cool, but remarkably free from impurities, as these are drawn into the large bag by which the water is lifted, and thus, after the withdrawal of a few bags of water, *the surface impurities* blown into the well were removed. Further, in these wells there is no layer of leaf-mould, as the means taken to keep the well deep enough for irrigation purposes effectually remove this injurious deposit. However, as a rule, except I was quite sure of the water, I invariably boiled it, and cooled and re-aërated it by pouring it from one vessel into another.

Railway Station Wells.—When we think how largely the railways are now used, not only for travelling, but for purposes of performing a pilgrimage, and how dependent the locked in passengers are on the water supplied to them by the water-men at every railway station in India, thanks to the wise forethought of that Solon of Indian Viceroys, the late Lord Dalhousie the importance of procuring pure water and of securing this purity will be self-evident; but if I may judge from the state of this public water-supply in my late sanitary circle nothing could be more disgraceful. True, I made suggestions on this subject, but they were unheeded, and for all I know to the contrary the railway station wells in this year's (1891) "Khoomb," or twelfth year festival at Hurdwar, may be in the same state they were in in 1879; and if water can contain in suspension the cholera germs, then I should think the railway wells at Saharanpur, Gazeabad, Toondla, and Agra have much to answer for. My suggestion was to cover the wells, and use a pump on them; or, better still, when the water was being drawn up to the "Williams" towers of defence for filling the engines, to let a large tank be filled, and *two* taps attached to this will, as I know, meet all requirements, and overcome all difficulties about caste, &c., as I proved at Mussooree.

Cantonment wells should have no trees over-shadowing them, and should have thatch covers, as all these wells once had at Meerut. All wells should be carefully examined, and those in which the water cannot be kept pure and good should be closed. The wells for the servants should receive the same attention as those used for the master, as, without doubt, if the truth were known, the water is often very indiscriminately drawn and served out. The locality of the latrine should be more carefully selected with reference to the servants' wells, and the Meerut cantonment is a very serious offender under this head.

City wells.—Favourite wells, such as the "Meeta Kooah" at Agra, should be carefully protected, and a pump used to raise the water. The

"lotah," in its first dip into the well is generally very dirty, and, in bringing up water for its own cleansing, fouls that from which it is drawn.

There is, however, in nearly every Indian well one great source of impurity more overlooked than anything I know of, and that is what I have alluded to before as *the leaf-mould deposit* at the foot of the wells. Now this deposit is the very substance in which is generated the germ which is credited with the production of malarial fever, viz., the product of decomposing vegetation, chiefly of leaves. The germs in this deposit when acted on by a tropical sun, pass into the air with the fluids raised by evaporation, or, as in this case, when suspended in the water, are taken into the system, when the water of wells with a deep layer of this deposit is used for drinking purposes. To anyone who has watched the cleaning of a well with the object of bringing up something which may have fallen into it, the true character of this deposit is clearly evident; and it seems to me that, in a masonry well with a good tube, every drop of water withdrawn from the well *must* have passed through this layer of leaf-mould, and in its passage must surely bring away some of the malarial germs present in this decomposing vegetation. Indeed, I believe that of the two great trains of symptoms in true malarial fever, one, a hot dry skin, relieved by a free perspiration, is due to the malarial poison, whatever it may be, having been inhaled; while the second, a sensation of cold, with an intense desire to be sick but inability to vomit, is due to this germ having been taken into the system when suspended in water which has been drunk, in much the same way that the train of symptoms differ in spontaneous and in inoculated small-pox. In spontaneous small-pox the eruption is, in many cases, present not only internally on the various mucous membranes, but also externally; this is doubtless due to the inoculation by the virus, both as suspended in the air and breathed, and in the food or water taken into the stomach. Now, when the virus is scientifically inoculated, as practised till lately in the Himalayas, where I studied it, no general eruption appears at all, everything is confined to the site of the small-pox virus insertion; on the other hand, when this inoculation is carelessly, or, rather, unscientifically practised, and small-pox crusts are swallowed as pills mixed with flour and coarse sugar, or these crusts in a very fine dry powder are blown into the nostrils, and thus inhaled, then the most serious results follow, the mortality is very high, and the eruption often confluent.

Now, as the native method of cleaning a well is not only expensive but very ineffective, hearing of Bull's dredger, I called on Mr. Bull when passing through Cawnpur in 1879, and at once saw that his dredger was the very thing I wanted to remove this deposit and to work down to the clean sand. I accordingly made a special report to the Government on the subject, and suggested a plan by which a Bull's dredger, placed on wheels, with a set of shears for working it, could be used in a group of stations, and transported by bullocks or horses from one station to another, in much the same way that a portable engine is made available in this country; but no notice whatever was taken of the suggestion, and I have little doubt that an examination of the

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deposit in the wells in most Indian cantonments, and particularly at Lucknow, would reveal conditions of insanitation which would raise the question, not why so many suffer from fever, but how it is that any escape.

When writing on the subject of the late alarming increase of enteric fever in India, I found on inquiry that the cost of a Bull's dredger, such as I have described, would be in India, complete with derrick, windlass, and 100 feet of chain, suitable for conveyance in a cart, and capable of erection in 15 minutes, 180 rupees.

And now I have done, and in conclusion would only repeat that everything here stated or suggested is to be found in my official sanitary reports for the first circle North-West Provinces, extending over 20 years, from 1864; and I can only state that, as regards this circle, with its large military cantonments in the plains, and its hill sanatoria in the Himalayas, the conclusion arrived at by the Sanitary Department in India, and in this country, to the effect that the value of the European soldier's life has greatly increased, owing to the improved sanitation of his surroundings, is just one of those delusions which, like a pricked air-bag, collapse before the sharp point of any careful inquiry.

The increased value of the soldier's life is due to a moral, not a physical sanitation, and total abstinence and its accompaniments have had more to do with this than all the sanitation which India has seen for the last 25 years. Take, for instance, the sanitary condition of the first circle as regards the work of the strictly sanitary department; it was worse in 1884 than it was in 1864, as I am prepared to prove, for the defects of 1864 were allowed to go on unheeded and unremedied till 1884, when a wide-spread epidemic of typhoid fever was the penalty of years of the grossest violation of the first principles of sanitation in the matter of the water-supply; and the cases of typhoid fever in the large hill sanatorium of Chuckrata in the Himalayas, and the increasing unhealthiness of Roorki, Meerut, Muttra, and Agra are evidences that neglected sanitation in the point of water-supply must bring a terrible retribution.

Enteric Fever in the European Army in India; its Etiology and Prevention.

BY

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[Note.—This paper is reprinted from Volume VIII.]

Enteric fever, as regards its frequency and diffusion, marks widely its difference to all other forms of disease; it knows no geographical limits, and its very universality and infectiveness makes it one of

peculiar interest to medical officers of the British Army, who, serving in various parts of the world and under varying conditions of climate, have ever to contend against this disease, often assuming, as it does, an epidemic form.

In India, the subject is one of special interest, inasmuch as there is a widespread belief, founded on a general impression—that most fallacious of all tests,—that enteric fever, although it has existed for many years in that country, has of late increased in spite of sanitary improvements, and of the vast sums of money expended by the State to place the soldier in the best possible position to withstand the effects of a tropical climate, and that the mortality each year is greater, rendering service there more hazardous than formerly.

A careful examination of the statistics bearing on this subject and published in the various reports shows that, notwithstanding the increase in the enteric fever death-rate, there has been a steady and regular diminution in the general mortality of the army serving in India, so that, although the deaths from enteric fever have increased, the general health of the soldier has greatly improved. This is seen from the following table, which gives the average annual mortality per 1,000, in different periods, during the present century.

AVERAGE ANNUAL MORTALITY per 1,000 of EUROPEAN SOLDIERS in INDIA, in different Periods.

1800–1830	84·60
1828–1844	54·09
1830–1856	56·70
1869–1878	19·30
1879–1888	16·02

In 1888 the death-rate was only 14·84 per 1,000, the slight increase over other years in the last decennial periods being due to heat-stroke, respiratory diseases, malarial fevers, and alcoholism, while there was no increase or diminution in the enteric fever death-rate as compared with that in the previous year.

In the statistical returns for India, typhoid fever first appeared in 1861, but in the tables for the decennial period 1860–69 all deaths from this disease were included under "remittent and continued fevers." In the decennial period 1870–79, the figures are probably far from correct, owing to differences of opinion as regards diagnosis.

During the ten years 1870–79, the mortality from enteric fever in the army of India averaged 2·03 per 1,000; during the six years 1880–85 it was 2·98; in 1887 it rose to 3·76; and in 1888 it was 3·75. This increase has been most marked in the Bengal and Bombay Presidencies; in Bengal the mortality was 2·28 per 1,000 in 1870–79, and 4·15 in 1888; in Bombay these figures were 1·75 and 4·04 respectively; the Madras Presidency gave 1·42 in the former period, and in 1888, 2·26.

But an important fact to be noted is that, concurrently with this increase in enteric fever mortality, there has occurred a decrease in the mortality from intermittent, remittent, and simple continued fevers.

Thus, in 1870–79, in India as a whole, the rate from these fevers was 1·42 per 1,000; in 1880–85 it was 1·02; whilst in 1887 it fell to 0·74, and in 1888, 0·73. This decrease was likewise most marked in Bengal and Bombay; in Bengal the mortality fell from 1·74 in 1870–79 to 0·34 in 1888, and in Bombay from 1·14 to 0·34 per 1,000. In Madras, on the other hand, the ratio of 0·62 in 1870–79, though it fell to 0·22 in 1880–85, and to 0·51 in 1887, rose to 2·19 in 1888. These figures are shown in the following table* taken from the Sanitary Commissions for India Report for 1888:—

—	During 1870–79.		
	Enteric Fever.	Other Fevers.	Total of both.
Army of India	2·03	1·42	3·45
„ Bengal	2·28	1·74	4·02
„ Madras	1·42	0·62	2·04
„ Bombay	1·75	1·14	2·89

—	During 1880–85.		
	Enteric Fever.	Other Fevers.	Total of both.
Army of India	2·89	1·02	3·91
„ Bengal	3·18	1·08	4·26
„ Madras	1·79	0·22	2·01
„ Bombay	2·77	1·55	4·32

—	During 1887.		
	Enteric Fever.	Other Fevers.	Total of both.
Army of India	3·76	0·74	4·50
„ Bengal	4·09	0·76	4·85
„ Madras	2·98	0·51	5·49
„ Bombay	3·40	0·90	4·30

—	During 1888.		
	Enteric Fever.	Other Fevers.	Total of both.
Army of India	3·75	0·73	4·48
„ Bengal	4·15	0·34	4·49
„ Madras	2·26	2·19	4·45
„ Bombay	4·04	0·34	4·38

* "Other fevers" include intermittent, remittent, and simple continued fevers.

The most obvious explanation of this increase in enteric, and concurrent decrease in other fevers is that it is owing to difference in nomenclature, that is, that deaths formerly returned as from remittent are now returned as from enteric fever.

This explanation is no doubt in part true; with increasing care and attention to diagnosis and to the fact that the presence of enteric fever in India is now universally admitted, it is extremely probable that there should be an exchange of cases from a "simple continued" and "remittent" column to an "enteric" column; but that this will not account for all the increase is evident. Other factors are also present, the chief of these is the large proportion of the young soldiers now serving in the country compared with the number so serving in former years.

The increased predisposition at an early age is now universally admitted as a character of the disease. During the five years 1884–88, the average mortality per 1,000 under 25 years of age was 5·61, while from 25 to 29 it was but 2·44. The larger the number of troops under 25 years, the larger therefore would be the total mortality. The proportion of men under 25 years was 74 per cent. of the total strength in the five years 1884–88; in the 10 years 1871–80, it was only 62 per cent., and the same fact was observed in the decennial period 1870–79; the mortality between the ages 20 to 25 was 4·30 per 1,000; above 25 years it was 2·20 per 1,000. The alteration of age-constitution would therefore account for some of the increased mortality. But in addition to this there is an even more important factor than age in pre-disposing to the disease. The disease most frequently attacks new arrivals in the country, and, with the present system of short service, there undoubtedly is a much larger proportion of men serving in India under five years than formerly; in 1871 the proportion was 64·6 of the total number; in 1888 it was 75·8. That it is especially the newly arrived soldier who suffers from enteric fever is made evident from the following table;—

TABLE showing the AVERAGE ANNUAL DEATH-RATE from ENTERIC FEVER in BRITISH SOLDIERS at different Periods of Residence.

—	First to Second Year's Residence.	Third to Sixth Year's Residence.	Seventh to Tenth Year's Residence.
1878–1887 - - -	6·7	2·1	0·7

These figures show that there is a certain immunity afforded by residence, and this appears to be much more perfect in tropical and subtropical regions than in higher latitudes. The protection acquired through acclimatisation cannot be denied, though what influence of its own a tropical climate has in this respect is uncertain. The increased

prevalence of enteric fever in India has therefore been accompanied by, and is possibly dependent on, an increase in the number of *young* and *recently arrived* soldiers.

Among much that is doubtful, it may now be considered as proven that enteric fever, as known in Europe, prevails in India; that it owes its prevalence to the same causes in the latter as in the former region, aided by the high temperature and humidity of the climate, and that some at any rate of these causes are widely diffused throughout India, viz., polluted soil and polluted water.

The cause of enteric fever has been stated by Eberth to be due to a specific Bacillus (*Bacillus typhosus*). Klebs and Gaffky have found similar bacilli in the spleen, mesenteric glands, and in the inflamed Peyer's patches, in fatal cases of this fever. It is now considered, with great probability, to be the cause of the disease, though not as yet actually proved. Fraënkel and Simmons state that they have reproduced the disease, by inoculation, from a pure cultivation of the microbe. From a review of all the evidence on this subject, it seems that Eberth's bacillus being the actual cause, has considerable, if not almost universal, support, and this, at all events, furnishes the best working basis from a sanitary point of view.

The fate of the typhoid bacilli in soil is early extinction, particularly in the presence of moisture, great dryness, or general decomposition (saprophytic); yet, from their ability to form spores, the soil, especially if not saturated with water, and not too cold (under 60° Fahr.), offers facilities for their subsequent increase and diffusion. We are unable to say that the soil serves as a breeding place for the virus, but we are justified in considering it to serve as a habitat for its spores, or for such resting forms as may reach it either directly from the sick or indirectly as the result of processes undergone by typhoid dejecta deposited or buried in it. The practical bearing of these considerations is to lend some confirmation or explanation of the local and seasonal differences in the distribution of typhoid fever, the dominant factors being a certain degree of soil-heat and level of soil-water.

Enteric fever in India prevails in its most virulent form chiefly in the months of April, May, and June. In these months the upper soil layers are at their driest, and have a mean temperature throughout the 24 hours of 72° Fahr. As this superficial soil becomes moist consequent on either rain or other causes, or when its mean daily temperature falls below 60°, then the disease abates.

The maximum range of soil temperature co-existent with disease prevalence is undetermined, but it is probably very high. High levels of subsoil water are co-existent with the moistness of the upper soil layer and consequent mechanical fixation, if not actual destruction, of the typhoid bacilli, as the result of decomposition or of saprophytic action. This agrees with a minimum prevalence of disease at times of considerable rise in the soil-water.

The condition of loose or porous soil after a fall in the soil-water and consequent access of air to the soil interspaces, to say nothing of increased heat, establishes facilities for the virus (now become potent, whether as spore or not) to be carried into the atmosphere with the upper soil layer, either as dust or with ascending air currents.

Without going so far as to say that any fluctuations of the subsoil water have no effect as mechanical agents for the introduction into wells of the typhoid spores or virus which may happen to be lodged in the soil, yet, in the light of what we know to be the behaviour of the specific typhoid bacilli in soil and the general limitations of microbean life to the upper layers of the soil, and the remarkable filtering influence of soil on the passage of bacteria through its interstices, one is forced to think this contingency is rare. If enteric dejecta do gain access to drinking water and wells from the soil, it is more probably by surface than by deep drainage.

Of course, outbreaks of this disease occur in places through various other circumstances, but they do not vitiate the value or importance of these conclusions regarding soil heat, soil dryness, and soil moisture.

The existing methods of disposing of excreta, though excellent in theory, are in many respects faulty in detail. As an example, I may give an instance, recorded by Surgeon Nichols,* of the Army Medical Staff, where the dry earth used for disinfecting the excreta was carried back in the same carts which brought the "soil," and was dug in in close proximity to the place where the filth was buried. Have we not here all the conditions necessary for the carriage of the disease?

Again, all who have resided in India must know of the liability there is to pollution of the wells from percolation of surface water. The habits of the natives are such as to defile the immediate neighbourhood of the wells, and, with a heavy rainfall, the surface impurities are rapidly carried into the water supply, without filtration through the layers of the soil. Is it any wonder, under such circumstances, that the disease is so widespread?

Enteric fever in India is the same disease as seen in Europe; both diseases are identical. The local and seasonal prevalence of the disease depend on soil heat and soil moisture, and these climatic conditions extend over wide areas and act upon localities always the same as regards a polluted soil. Certain local conditions exist in India which, aided by temperature and humidity, probably increase the virulence and assist in the diffusion of the poison.

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* B.M.J., Vol. II., 1890, p. 1091.

Hygiene for the Zenanas of India.

BY

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[NOTE.—This paper is reprinted from Volume IX.]

More than 20 years ago Miss Carpenter, sister of our renowned physiologist, hearing much of the low social condition of the women of India, determined, although then in the seventh decade of life, to go and see for herself, in view to, if possible, its amelioration. She founded, in 1870, the Association,* of which the Princess Alice became the President, and which is now under the patronage of the Princess of Wales. Miss Carpenter, being much impressed with what she saw, viz., amongst other things by the great need for female education and improvement and for better sanitation, paid other visits to India, but died in 1877. Stimulated by her example and exertions, the Association has spared no efforts to carry out her views; branches have been established in some of the principal social and educational centres, an active interest being taken in them by high official authorities; its magazine has been utilised for conveying information on the best means of preserving health in India; and its promoters may fairly be congratulated upon the progressive fulfilment of the objects with which the Association was founded. Following Miss Carpenter's example, the honorary secretary, Miss E. A. Manning, paid a visit to India in 1888, to inspect the several branches, and to bring them more into rapport with the parent institution at home.

Nearly half a century ago, the Government of India tentatively initiated the experiment of sending four intelligent young native gentlemen of good caste to England, to study medicine under the superintendence of one of its ablest medical officers, Dr. H. H. Goodeve. The experiment was eminently successful; and the door being thus opened, other young Indian gentlemen voluntarily came to England, from time to time, for the same purpose. Now they come in increasing numbers to study not only medicine, but various callings which, it is hoped, will, on their return to India, be of use to themselves and to their country. To all who wish to avail themselves of its aid, the National Indian Association is prepared to stand, as it were, *in loco parentis;* to provide them with suitable accommodation, to show them the best side of English society, and to introduce them to a knowledge of such institutions as may especially benefit them. It is to be regretted that, in some cases, these gentlemen come too young. And here I would urge that all medical students from India should be encouraged to thoroughly study hygiene.

* Subsequently called the National Indian Association.

It is somewhat remarkable that, although the natives of India, the Hindus especially, attach great importance to personal ablution, which is indeed a religious obligation, they do not seem to recognise the necessity for healthy surroundings. The management of the lying-in chamber is a striking illustration of this. Indian mothers look upon fresh air as positively injurious to the infant, and to exclude it as well as the possible entrance of malignant spirits, they take infinite pains to close every door and window, and to fill up every crevice; so that there is a complete absence of ventilation, the room resembling, says Kunye Lâll Dey in his "Hindoo Social Laws and Habits," "an hermetically sealed box." In this darkened chamber—a large fire burning in the centre even in the hottest weather—the mother and child remain, inspiring a vitiated atmosphere for 21 days, till the ceremony of the *Shūsti pūja* is performed. Imperfect ventilation is, indeed, a characteristic feature in all Hindu dwellings. The sitting and reception rooms of a native house in Calcutta intended for the male members of the family are comparatively spacious, as is the *dalān*, or hall for the celebration of the *pūjas* and festivals that take place on the premises. There is also a court-yard for *nātches* and other entertainments. But, in the *untuppoor* (zenana or female apartments), in which the men are apt to sleep half their time away, a very limited amount of breathing space, much less than the quantity considered necessary in a tropical climate, is allotted to each individual. And, in the immediate neighbourhood, are the cooking rooms which have no proper outlet; the *austakoor*, or place to receive their refuse—a kind of dust-bin; odious privies, too often left uncleaned; wells sunk almost directly beneath these privies; the tank for the women who here wash their clothes and themselves; in short, an abundance of impurities, the contemplation of which led a well-known practitioner some 50 years ago to write that it would be difficult to find, in any city, "more fruitful and fatal causes of disease and death concentrated within narrower limits." An improved water supply and better drainage—the sewage of Calcutta is now drained away into the Salt Lakes,* instead of being deposited (as formerly) in the river (the principal drinking water of the city) at the rate of 180 tons a day—have greatly contributed to improve the health of the city generally, notably in the diminution of cholera. But these reforms, though appreciated by the native community, have been introduced by the ruling power; they are not the result of the growth of native public

* The liquid sewage is conducted by a main sewer into the circular canal, whence it is supposed to find its way into the tidal Bidridhuree river (which is practically an arm of the Bay of Bengal), there to be tossed about and finally deposited at high tides in the Salt Lakes, with which the Bidridhuree communicates. The system is considered by eminent medical authority to be very unsatisfactory. The liquid sewage, it is urged, should be made to discharge at a point much lower down—into an arm of the sea which does not communicate with the Salt Lakes, nor with the country near Calcutta. The "dry sewage" (street sweepings, &c.), all that the sewer does not carry off, is conveyed by municipal carts and by railway to an area of municipal land about a mile square, where it is laid down in layers from eight to ten feet in thickness, thus raising the land which originally was very low.

opinion. And I am not aware that, as yet, there is any material difference—so conservative are the people and so indisposed to brook any change that affects the *Ma Bāp ka dustoor* (ancient customs)—in the insanitary condition of the houses, and their immediate surroundings. Let anyone take a walk through the Tiretta *bazaar* (in the northern quarter of Calcutta) at day-break before the inhabitants are astir, and he will probably see men asleep (in the hot season), as I have, on *chārpāis* (country bedsteads) placed in front of the houses, close to, if not directly over, one of the open street drains, which are not always only water drains. Can it be surprising that cholera should be endemic—about 4,000 on an average dying annually in the past? or that the natives should have so little stamina wherewith to resist it? As a matter of fact, 92,520 were swept away by the disease in 20 consecutive years. With improvement in the hygiene of the home, the mortality from this disease would be still further diminished.

We sometimes wonder why our military cantonments, upon the public buildings in which so much money has been expended, should become unhealthy. In some cases there may have been physical objections, perhaps overlooked or insufficiently considered, to the site; or, possibly, other causes beyond human control may have unexpectedly supervened. But, in others, more frequently too than the European authorities are aware of, the unhealthiness is of the natives' own causing. For example, cholera appears in a bazaar in cantonments; and, upon the advice of the administrative medical officer or staff surgeon, a temporary hospital is erected a sufficient distance off from the cantonment for the reception of such cases. But, not unnaturally, the sick do not like to be taken from home, and the occurrence of cases is therefore not reported. The inmates of the infected house "lie close," and the cholera dejecta, instead of being disinfected, removed to a distance and there buried, are either thrown into a corner of the premises or placed in a shallow excavation hurriedly scraped out for the purpose in the immediate vicinity of the house. I have met with a similar case when marching with an irregular cavalry regiment. A trooper, seized with diarrhœa, the preliminary symptoms, apparently, of cholera—had the dejecta buried in his tent.

The amount of crowding in the sick chamber is often excessive. Fresh air, so essential to the prevention of ante-mortem clots (embolisms), an occasional cause of sudden death after surgical operations—is the last thing thought of when such a catastrophe is threatened. In some parts of India, in the comparatively low and damp parts particularly, *e.g.*, in Bengal proper, *phthisis pulmonalis* is not uncommon amongst the women; and without doubt, overcrowding in small rooms contributes to this. Men also thus suffer in the same localities.

The feeding of infants, whose "stunted growth, constant sickness, and early death" is often due, says Kunye Lâll Dey, to the substitution of inferior *meethaees* (sweetmeats) for the mother's milk at the time of weaning, and to the free consumption of immature fruit, is a subject upon which the mothers of India require much enlightenment. About 30 years ago a lecture was given, in Calcutta, by a native gentleman who

advocated the use of butcher's meat and alcoholic drinks by Bengalees; urging that, as such a dietary gave strength to Europeans, his countrymen would do well to adopt it. Mistaken counsel! And the increase of liver disease during the past 25 years, amongst the Bengalees and others who have followed it, only too certainly proves its fallacy. The lecturer, who overlooked the fact that Britons owe their superior physique, in the first instance, to a Northern clime, would have given better advice had he recommended his countrymen to adhere to the simple vegetarian diet suitable to a tropical climate, to indulge less in sweetmeats and *ghee* (clarified butter), and to abstain altogether from every description of alcoholic drinks, which tend to *reduce* the strength of Europeans and of all who use them.

How best to counteract the influence of malaria and of impure air and water—the natives are familiar enough with the *effects* of these agents, as is evident from the expressions "*huwa** *lug gya*" "*panee*† *lug gya*"—is another lesson of paramount importance.

The opening, now offered through the instrumentality of the "National Indian Association," for instructing Indian mothers in the laws of health in a familiar and unscholastic way in their homes, as also to girls at school who in due course will become mothers, is one that, if judiciously utilised, may bear excellent fruit; for, after all, the women are at the root of all social reformation and progress.

The Association has acted as a pioneer in originating and quickening the movement for providing skilled female medical aid for the women in the zenanas, into which no medical *man* has ever been allowed to enter, and who were, therefore, hitherto dependent upon such professional assistance as could be obtained from their own sex in India.

This indigenous assistance is now known to be of the worst possible description. The subject having been ably dealt with in the "Contemporary Review" by a medical lady, Dr. Frances Hoggan, the "National Indian Association" took it up. Meetings were held under its auspices; an impetus, fostered by the Queen herself, was given to the project for sending to these poor women thoroughly well taught lady doctors from England, and for educating the native midwives (dhāees). The entire scheme was thus well ventilated, and, at length, through the benevolence of Mr. Ketteridge, of Bombay, supplemented later by that of several Parsee gentlemen, it assumed a definite shape. A hospital for the reception of native female patients was established; and an income, for three years, for two accomplished lady doctors from England was guaranteed.‡

The scheme, thus initiated, commended itself to the wife of the then Viceroy, the Countess of Dufferin, who, with the sanction of the

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* "The air has struck me."

† "The water has struck me."

‡ Prior to this, the idea of giving a medical education to Indian women had originated in Madras, and Surgeon-General Balfour had induced the Madras Government to throw open the Medical College to them. Mrs. Scharlieb, who has since distinguished herself at the University of London and in other ways, was one of the first students.

Indian Government, and cordially assisted by local authorities and medical officers, and by native princes and gentlemen in various parts of the country, has completed the foundation of a great social reformation.

Provision had already existed for the treatment of women in some of our hospitals and dispensaries; but the doctors have been *men*. Women of high caste—*purda nishins*—(screened from the public gaze) would not avail themselves of it. For these hospitals are being established; and either in them or at home they have now the opportunity of receiving, when ill, the best possible professional treatment at the hands of their own sex.

I would urge that all female medical officers should be thoroughly well informed in the subject of sanitation and the laws of health, so as to be able to impart their knowledge in a pleasant popular way to the inmates of zenanas. Lady doctors from England might be encouraged, as well as the male medical students from India, to take the degree in State medicine required for sanitary medical officers in England.

A strong impetus is being given, and in this the "National Indian Association" takes an active part, to the school education of Indian girls, and it is certainly very desirable that hygiene should be included in the curriculum of study for girls as well as boys, especially in normal schools. Indian girls are remarkable for their zeal in learning whatever they are taught, and there is no reason why they should not, by-and-by, excel in teaching this subject, as some of their sisters excel in other intellectual efforts.

Why should not our sisters in India, when sufficiently educated, work as zealously and as effectually for their country as so many noble women in England (amongst whom stands prominently forward one who, 37 years ago, gave so powerful an impulse to the subject that brings men and women of various nationalities together to-day—the Hygæia of England, Florence Nightingale) have done for ours? A valuable sanitary primer, called the "Way to Health," has been published (in English) for the Education Department in the Punjab, and, on the representation of the "National Association for Supplying Medical Aid to the Women of India," the Indian Government have published a new edition, with translations of the work. A text book on domestic economy and sanitary science for the use of the senior classes of English and vernacular schools, which gained the reward of a thousand rupees offered by Government for the best treatise on the subject, has also been published.*

These are excellent publications, likely to do much good as text books in the higher schools; but there is room, I venture to think, for others (in the vernacular) suitable for elementary village schools and for use in the zenanas. In this connexion lady doctors for India would

* A similar work has recently been prepared by Mrs. Brander, Senior Inspectress, for the use of teachers in the Madras Presidency.

do well to examine the works published by the "National Health Society" and by the "Ladies' Sanitary Association." The natives of India are very fond of proverbs and stories. The *kuhāni-wāla* (story-teller) is always a welcome visitor in inns for travellers, and wherever people congregate; books, therefore, on hygiene, published on these lines, would, I believe, be very popular. I speak from personal experience.*

There is one important point in connexion with the laws of health which should not be overlooked, viz., the physical development of the body in athletic exercises. These should, always, be apportioned to the capacity of the individual. Sufficient care in this respect is not always taken, even in England; and, in consequence, it occasionally happens that the life of a lad who might otherwise have grown up into a fairly strong man is embittered, if not shortened, owing to the germs of disease—the result of too rough exercise—being laid before the body was fully formed. If this be so in a race remarkable for a powerful physique, how much more is it necessary that care should be taken in tropical regions where the youthful frame is, as a rule, so much inferior.

There are other subjects which, though not usually included under the head of hygiene, might well be taught to the youth (of both sexes) of India in connexion with preventive medicine. One of these is the extermination of poisonous snakes which, in conjunction with wild animals, annually destroy their thousands. Under the present system a reward is given for every dead serpent brought before the magistrate or civil authority of the district. But this plan does not, apparently, effect an appreciable reduction in the mortality. This is not surprising when it is remembered that a cobra-di-capello lays from 18 to 20 eggs at a time, so that, for every one captured a large number remain at liberty. I advocate, therefore, that the eggs of snakes—these are to be found in the neighbourhood of old walls and where the sun can reach them—should be secured. There is at present an obstacle to any extensive capture of snakes in the attitude of the people themselves, who offer religious objections to their destruction. Supposed to be associated with Deity, they are, in some parts, well cared for, and even worshipped. The low caste natives, therefore, who will alone undertake the work of extermination, receive but scant assistance from the community at large. But, as with progressive enlightenment, this superstition, with many others, will disappear, and the true character of these reptiles be clearly understood, we may reasonably hope that the individual slaughter, now conducted at such a disadvantage, will give place to a more comprehensive system of extirpation. The only other egg which is likely to be mistaken for a snake's is the lizard's, but there is really no difficulty in distinguishing between them. The snake's egg (oblate and white) has a soft but toughish leathery covering,

* I once published a pamphlet of the kind, which remained for many years a text book in the village schools of the North-Western Provinces, serving as a pioneer for a more comprehensive publications. Destroyed during the mutiny of 1857, it was afterwards reprinted under the orders of Government.

whilst the lizard's has a hard shell. To distinguish between the eggs of poisonous and non-poisonous snakes is, however, impossible. But in a case of this kind there need be no compunction in destroying the innocent with the guilty.

The work of introducing preventive medicine amongst a people who believe that almost all disease is sent by angry gods, powerful demons, or evil spirits, must necessarily advance *pari passu* with religious as well as general enlightenment. Happily, sanitary measures, partial or complete, introduced into some of the larger towns, have met with no serious opposition from the natives; *e.g.*, they will drink and otherwise use water conveyed through pipes, though they will not use it for religious ceremonies; but the stronghold of custom and prejudice is in the *home*, the assault and carrying of which, by gentle methods peculiarly their own, can best be undertaken by women—the medically educated and noble-hearted daughters of the United Kingdom.

India Factory Legislation.

BY

HOLT S. HALLETT, C.E.

[NOTE.—This and the following paper, together with the subsequent discussion, are reprinted from the proceedings of the Demographic Division.]

In the census of 1881 one-twelfth of the population of India was classed as "workers" in various materials. Of these more than 8,000,000 were distinguished as females, and nearly 13,000,000 as males.

In the British Isles such workers are protected, so far as females and young males are concerned, from the exactions of their employers by our factory and workshop legislation. In India, however, where the patient endurance of the people surpasses imagination, and the sweater is master of the situation, protective legislation is refused to the great bulk of the working classes. Barely 50,000 women and children out of the 10,000,000 or 12,000,000 women and children employed in industrial pursuits have been brought within the scope of the recently enacted India Factory Act.

Under the India Factory Act all workers of both sexes and all ages who are engaged in the following works are excluded from protection :—

1. Factories employing less than 50 hands, with exceptions which may be made by local governments for factories employing not less than 20 hands.
2. Factories working less than four months in the year, which include most of the cotton presses and ginning factories.
3. Factories on indigo, tea, and coffee plantations.
4. Workshops.

I will first deal with workshops and the minor factories which are excluded from the Act. Owing to workshops not having been brought under regulation, children of any age, from babies in arms upwards, may be employed in them for any number of hours in the day or night, and under most insanitary conditions. After inspecting a few of these works in which wool and wheat cleaning was being carried on by hand, and the dust was nearly suffocating, Mr. Jones, one of Her Majesty's Inspectors of Factories, whose services were lent to the Government of Bombay in 1883 for five years, described them as follows:—

"1. Room, 87 feet by 15 feet by 13½ feet. Five small openings, 3 feet by 2 feet, blocked with wood, and two doors. One hundred and four women and children employed in this room, 11 children under 12 years of age, and three at the breast. Room extremely dirty.

"2. Room on the opposite side of the road, belonging to the same man. Room 84 feet by 9 feet by 10¼ feet; seven windows and three doors; walls and roof very dirty. Ninety-two women and 16 children under 12 years of age, three at the breast.

"3. Plenty of ventilation, walls and ceilings very dirty, and dreadful smell from adjoining yard; 90 women and 16 children, from two to 12 years of age, employed.

"4. All the windows blocked by bags; room perfectly dark, except at the doorway; place excessively dirty; filthy drain running between building and the next premises. I was obliged to hold my handkerchief to my face while taking down these particulars."

The condition of the minor factories is even worse than that of the workshops, because danger from unguarded machinery and untrained enginemen is added to the general insanitary condition of the premises. These factories, besides many other works, include cotton presses and cotton ginning factories, the majority of which work less than four months in the year.

In cotton presses and ginning factories the air is choked with cotton dust and fluff, and in the presses the work is extremely arduous. Mr. Sharpe, the engineer of the Apollo Press Company, in his evidence before the Bombay Factory Commission of 1875, declared that:—

"The coolies perspire heavily and profusely, drink much water, and get tired with their work, because they are employed continually for 12 hours per day on work ten times as hard as that of mill operatives. Their working hours should not be more than six. The coolies are allowed no meal hours, and take their meals as they find opportunity. They suffer from the cotton dust."

Mr. Henderson, the engineer to another press, urged that: "The "operatives are not healthy, most of them suffer from asthma. The "hours are too long for such heavy work. The work kills the men. "They should not be allowed to work longer than eight hours. An

" enactment is necessary for the protection of the operatives. How can " you expect to make changes without an enactment?"

No enactment was passed for the protection and relief of these operatives, so the merciless employers took further advantage of their helplessness. Before the Bombay Commission of 1884, it transpired that men, women, lads, girls, and children employed in the cotton presses and ginning factories were occasionally worked continuously for eight and 10 and 12 days and nights at a stretch, with a rest of half an hour in the evening; and, as a rule, from 4 and 5 a.m. to 7, 8, and 9 p.m., without any stoppage during the day. If six or eight hours a day is as long as a man should be employed in these works, it is surely abominable cruelty to allow lads, girls, women, and children to be employed in them day after day for 23½ hours at a stretch.

The case for protecting the hands in minor factories and workshops was so strong that the Bombay Factory Commission of 1884, though largely composed of persons interested in Indian factories, allowed in their Report that every work employing a single member of the protected classes ought to be under regulation. They said:—

"We are strongly of opinion that all factories—no matter what the number of hands employed—in which steam, water, or other mechanical power is used, should be under regulation, and that other places or workshops where manual labour is exercised should be brought under the law if 10 members of the protected classes are employed therein. We may add that we draw the line at 10, owing to the impossibility, without more inspectors being appointed, of enforcing the law in workshops employing less hands."

To work children, young persons, and women beyond certain limits, is to work them beyond the point where work becomes cruel and injurious to the employed. Captain May, one of Her Majesty's Inspectors of Factories, laid a very clear statement on this subject before the Factory and Workshops Acts Commission of 1875. He said:—

"I apprehend that it is the duty and right of a Government to restrict the hours of labour, so far as to prevent cruelty and injury to the labourer; but that it is neither its duty nor its right to restrict them any further. I consider that this cruelty and injury point would be reached, unless in exceptional cases, by the Acts of 1864, 1867, 1870, and 1871, if slightly amended; or, in other words, that an average of five hours of work per day for children, and 10 hours for young persons and women, is neither so cruel nor so injurious as to require further legislative reduction. In the case of boys, I should not lower the age, *i.e.*, 18, for unrestricted labour, because in many instances the stripling of 16 is less able to bear excessive work than the boy of 13 or 14."

Some surgeons, well acquainted with the effects of factory labour, have placed the injury point beyond which young persons between 14 and 18 years of age should not work considerably below 10 hours a day, and have expressed the opinion that standing for five hours a day at a machine is too much for a child between the ages of 10 and 14.

In his statement "On the Physique of Factory Children," forwarded to the Factory Commission of 1875, Mr. Charles Roberts, F.R.C.S., who investigated the subject for the purposes of Dr. Bridges and Mr. Holmes' "Report to the Local Government Board on the "proposed changes in hours and ages of employment in textile "factories," urged that:—

"From a physical point of view, I am of opinion that—

"A child under the age of 10 years should not be allowed to work in a factory or workshop.

"From the age of 10 to that of 14 they might be allowed to work half-time at occupations which do not require much physical strength, or a constrained position of either standing, walking, or sitting.

"From the age of 14 to 18 they might be allowed to work three-quarter time, and after that age full time in factories and workshops.

"These rules should apply equally to both sexes."*

In the course of his investigation he had found that—

"Flat-foot and a general disposition to knock-knee is very common among the factory children, and increased with age; while both these deformities are rare among agricultural children."

After examining many thousand operatives, he found that no less than 132·4 per thousand factory workers of 12 years of age were affected with flat-foot, while at the age of eight the ratio was only 15·1 per thousand. This shows conclusively the evil effects that standing for five hours a day has upon the framework of children. Yet the India Government has sanctioned an Act which allows children of nine years of age to work standing at a machine for seven hours a day.

In factories coming under the India Factory Act of 1891, lads over 14 years of age are classed under the Act as men, and girls over the same age are classed as women. Lads and men are only so far protected by the Act that they are allowed one day's rest in seven; and in factories not working on the shift system, are granted an interval of half an hour for meals at noon. Lads and men engaged in factories working on the shift system may be employed day and night for six days in the week, or 144 hours a week without rest; and for 141 hours a week in mills using electric or other artificial light, but not working on a shift system. Even in mills not using artificial light, men and lads may be kept at work from dawn to dusk, a period of about 14 hours a day, or 84 hours a week, in the hottest season of the year—double the number of hours that Mr. Roberts considered young persons under 18 years of age could be employed in a textile factory without risk of injury to their frame and constitution.

Under the Act girls and women are permitted to work 11 hours a day, or 66 hours a week, or 9½ hours a week longer than they may work in textile factories in this country. In factories not working on a shift system, the period in which women's work may be taken is between 5 a.m. and 8 p.m., the same as that fixed for children, and

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* For the opinion of medical men in India, *see* Appendix A.

this in face of the fact that the Bombay Factory Commission of 1884 urged that—

"Women and children should not be allowed to work before 6 a.m. or after 6 p.m."

Only one and a half hours are allowed for a woman's meals, and only an aggregate of half an hour for those of children. Owing to the loose limits in which work may be performed, a woman may be working 22½ hours a day on the shift system, or 13½ hours a day in a factory not working on the shift system, instead of the sanctioned 11 hours; and a child may be working 14½ hours, instead of the sanctioned seven hours, without the inspector having any possible check upon, or clue to, their proceedings.

The India Factory Commission of last year stated that :—

"The result of the present law has been that hundreds of chidren between the ages of nine and 12 are now daily employed in India as full-timers, doing 12, 13, and 14 hours' work, to the great detriment of their health."

When the law is broken the operatives dare not tell the truth to the inspector, because they are well aware that if they did the manufacturer would turn them out of his works. This has been clearly proved by Mr. Jones's Report, contained in the Annual Report of Her Majesty's Chief Inspector of Factories and Workshops for 1887, where, in referring to the trial of a manufacturer in India on the charge of employing children for months over-hours, and not allowing them the legal time for meals, and deducting half the amount due to them in wages on various pretexts, he stated that—

"There was no doubt in the minds of the magistrate, my own, and the police, that these children had all been frightened into making this denial of their first statements; but as their master was the only large employer of labour in the district a quarrel with him meant semi-starvation."

The shift system sanctioned for India combines the evils of loose limits with the still greater evil of allowing women and girls, as well as lads, to be employed at night. Night work is injurious and contrary to nature. Night was made for sleep and not for work. For children under the age of 21, working at night was abolished in this country by the Apprentice Act of 1802, and in each succeeding Factory Act it has been prohibited for all up to the age of either 21 or 18. In 1847 it was abolished for women in textile factories, and in 1867 for women employed in non-textile factories and workshops. At the Berlin Labour Conference it was prohibited for women and children, and for all young persons under the age of 18. In India night work is especially harmful. It is well known that more people are seized with, and die from, heat apoplexy in that country at night than in the day. It is rather late in the century for the Government of India to pass a Factory Act sanctioning night work for young persons and women!

The India Factory Act permits protected children of nine years of age to be employed without a certificate of physical fitness for 42 hours a week, notwithstanding the enormous weight of evidence given before the Factory and Workshops Acts Commission in this country against

permitting any child under 10 years of age to be employed in either factories or workshops, and in face of the fact that children between 11 and 14 years of age are, by the English Act of this session, only allowed to work 28¼ hours a week in textile factories in this country, and that no child under 11 years of age is permitted to work in any factory or workshop.

Mr. James Platt, the great machinist of Oldham, who has visited most countries where spinning is carried on, and is an expert on the subject, has given his opinion that :—

"The spinners of India, with the single exception of Lancashire operatives, are more deft with their fingers than any other operatives in the world."

An English operative is allowed to be not only the best spinner, but also the most efficient weaver in the world. A Lancashire weaver, with his assistant, attends four looms, against two tended by his Scotch rival, and runs his four looms at a greater speed. Yet the provisions of the British Factory and Workshop Act are deemed as necessary for the protection of Scotch as for English operatives. Why, then, should an exception be made for India? To work an ill-fed and wretchedly-housed Indian operative, of far less physical capacity and stamina than an English operative, for a greater number of hours, because he can turn out less work per hour than an English operative, is as wicked and cruel as it would be to work an English child for double the hours a man is employed, on the plea that the child only turns out per hour one half of the task of a man.

To work men and lads, from 14 years of age and upwards, under the penalty of dismissal from employment if they refuse, for 14 hours a day, in a standing position, during the hottest time of the year, with only half an hour's interval for meals and rest, and one or two necessary intervals of a few minutes for answering the calls of nature, is a disgrace to India manufacturers, and calls loudly for redress by Government legislation.

I will now treat with the statement of reasons for not applying the English Factory and Workshops Act to India, given in the despatch of the Government of India to Lord Cross, dated Calcutta, March 5, 1889. The statement runs as follows :—

"We desire to give expression to our view that the English Factory Acts are inapplicable to the present conditions of labour in Indian factories. It is a well attested fact that the employées in Indian factories reach a standard of comfort and content which is not attained by persons in their own ranks of life who are engaged in pursuits of a different nature. Machinery, moreover, is, owing to the comparative absence of competition, driven in the factories in India at a pace so slow that it would not be tolerated in England, and it is estimated that in many of the mills in India about twice as many operatives are employed as would be employed in mills of the same capacity in England. It follows that the work of the operative in an Indian factory is far more desultory and less exhausting than that of an operative working in England, and that provisions which are rendered necessary by the

exacting nature of the labour in English mills, are not demanded in the interest of the Indian operatives, who would, indeed, be prejudicially affected by them, while they would impose a needless and uncalled-for obstacle to the development of the industries of India."

Let us see how this statement stands the test of evidence given by mill managers, factory inspectors, medical men, and operatives before Factory Commissions which sat in India in 1875, 1884, and 1890. If suffering, through cotton dust and defective ventilation, from chest diseases, inflammation of the lungs and air passages, and derangements of the stomach; if sleeping in damp and crowded dens for part of the night, and exposed to the inclemency of the weather in the open air outside the mill for the remainder of the night whilst waiting for the doors to be opened at daybreak; if having to rise at 3 a.m. to cook their meals, or else going to work without breakfast; if toiling from dawn to dusk every day, a period of 14 hours during the hottest season of the year, in factories artificially heated by steam, with one single interval for meals and rest of a bare half hour, from which the rapacious masters generally manage to crib at least 15 minutes; if risking the cripplement of their frame and deadly injury to their constitution through working in a standing position for 14 hours a day in an enervating atmosphere laden with cotton dust, fluff, and disease; if being driven and bullied and beaten by overseers armed with canes; if being denied all time for recreation and domestic happiness; if being grudged their hard-earned wage-pittance, and being paid their earnings, instead of by the week, as in this country, by the month, and frequently a fortnight and even two months in arrears; if being thus forced, an easy prey, into the web of heartless and unscrupulous money lenders, who mulct them in an interest, according to Mr. Factory Inspector Jones, varying from 75 to 225 per cent. per annum; if all of these form "a standard of comfort and content" for operatives surpassing that of less favoured "persons in their own rank of life who are engaged "in pursuits of a different nature," in which must be included minor factories and workshops—nothing further can be required to prove the urgency of applying our British Factory and Workshop Act to our Indian Empire, so that these miserably degraded and joyless toilers in dark, dirty, dusty, overcrowded, and unwholesome dens; these puny, over-tasked natives of India; these children of children who, according to Sir Richard Temple, in his speech on the address in 1888, have only one-fifth the strength of an Englishman, and are naturally capable of doing only one-fifth of the labour; these wretched beings scrambling for work at any price, knowing nothing of the real pleasures of existence, slaving as no slave would work, with unremitting energy, in the hope of earning a little extra money at the dearly bought price of their health; these human beings, our fellow subjects, who are treated worse than beasts of burden, may be raised from their present state of moral and physical degradation, and rescued from the inhuman exactions of their merciless taskmasters who are wringing the very life out of them.

The statement that "machinery is, owing to the comparative absence "of competition, driven in the factories of India at a pace so slow that "it would not be tolerated in England," may have been true 20 years

ago, but it is not true, in the case of mills with the newest machinery, at the present time. It was conclusively disproved by the evidence of managers of Bombay mills and people well acquainted with their working, before the "Bombay and Lancashire Cotton Spinning Inquiry" in 1888, where it was stated, without dissent, that cotton spindles are run as fast in India as in Lancashire, and that the Indian operatives are increasing in skill.

Anyone acquainted with the history and results of factory legislation in this country must know that the enactment of the British Factory and Workshop Acts in our Indian Empire could not prove otherwise than a boon to the working classes of that country. The English Legislature extended its protection to children, young persons, and women in the face of a powerful opposition on the part of the manufacturers; but it cannot be denied that the English Factory and Workshop Acts have conferred the greatest possible benefit on the operatives, without diminishing the profits of the employers in any way. The same reasons that are still put forth in India against factory legislation have been urged over and over again in this country, to prevent the passage of our Factory Acts, but in vain; and there are ample facts to hand to clearly indicate that the imposition of the British Factory and Workshop Acts in India would not impose the slightest obstacle to the development of the industries of that country.*

It is owing to ignorance of such facts, and to the consequent continued belief in the long since exploded plea of manufacturers, that all factory legislation restricting the hours of labour must tell adversely against the industries of a country that has induced the Government of India to deny due protection to the working classes of that country. The Legislative Council of India is dominated by the capitalist interest. Capitalists form part and parcel of it; but the working classes are not represented on the Council, and a deaf ear is therefore turned to their claims and entreaties for protection; and to the advice of Government of India medical officials who have urged that men should only be employed in factories for nine or ten hours a day, women for eight or nine hours, and children for five or six hours.

To ensure the enactment of suitable protection for the Indian working classes, the Reports of the India Factory and Sanitary Commissions that have been held, together with the evidence and all existing reports and opinions of India Factory Inspectors and Health Officers, should be laid before the "Standing Committee on Trade and Manufactures" in this country, and instructions given to that Committee to draw out a comprehensive and adequate Factory and Workshop Act for our Indian Empire, in order, in the words of Lord Cross, "to "secure, without fail, for the various classes of operatives in India, an "amount of protection for life and limb, and an amount of security "for the health of women, young persons, and children, not inferior to "that which is afforded by the law of England."

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* For the effect of reduced working hours in factories, see Appendix B.

Appendix A.

Medical Opinions upon the Hours of Labour in Indian Factories.

1. Dr. Thomas Stephenson Weir, Health Officer to the Bombay Municipality, in the course of his evidence before the Bombay Factory Commission of 1875, said:—

"He had been in Bombay more than four years, and had made himself practically acquainted with the mills. He had visited some of them, both privately and in his capacity of Health Officer, at different hours and on various occasions. No child under the age of 10 years should be employed in the mills, and children between 10 and 14 years of age should not work more than six hours. The hours of work in the mills were too long. Men ought not to work more than 10 hours, exclusive of their meals. The temperature of 98 degrees was too high for operatives to work in for long hours. He would commend 90 degrees as a maximum temperature."

2. Dr. Joseph Anderson, House Surgeon in a Bombay Hospital, said, before the same Commission, that—

"He had been 21 years in the hospital, and was medical officer to two of the mills, one of which had been in his charge for 18 years. There are cases now and then among the mill people of chest diseases, inflammation of the lungs and air passages, and derangement of the stomach, all due to long confinement in the mills. The atmosphere of mills is injurious to all. The temperature is too high and the atmosphere is fluffy. The present hours of work are too long for all classes of operatives. He proposed a working day of 11 hours, out of which one hour should be given for meals and rest. He would allow 66 leave days, including Sundays. He considered a day's rest, after a week's work, a physiological necessity."

3. Dr. Lumsdaine, the Sanitary Commissioner of the Bombay Presidency, who in 1878 was instructed by the Government to carefully inspect the factories and report on their condition, and as to the protection which should be given to the operatives, after inspecting 22 of the cotton mills, urged in his Report that—

"I think impartial opinion will say the hours of labour ought to be reduced. For men, I would suggest 10 hours; for women, and boys from 13 upward, nine hours; and for children, six hours; and in this time I would give one interval of half an hour in the forenoon and another in the afternoon; so the real working time would be nine, eight, and five hours. On purely physical grounds I would close the mills one day in every seven."

4. Report of the Bombay Sanitary Commission of 1884.—This Medical Commission was composed of Surgeon-Majors Lyon, Gray, and Waters. In the course of their Report they stated that—

"We think it very desirable that the daily working hours of these mills should, both in the interest of the general health of the operatives and with a view of preventing accidents from working in rooms insufficiently lighted, be defined by law; and that, further, in the interest of the general health of the operatives, it should be compulsory to allow

certain periods of rest in the day, and a certain fixed number of holidays, say four, per month. Lastly, we have to state that we are of opinion that the present limit of age for children, seven to 12, is too low. We think the lower limit should be raised, as in England, to 10. The upper limit ought, we think, also to be raised, say to 14. We have also to say that we have visited several of the minor factories, and that from the result of our visit we are of opinion—

"1. That on account of the danger to life from fires, explosions, accidents from unfenced machinery, &c., every such factory employing machinery, other than machinery worked by hand or animal power, should be placed under supervision.

"2. That on account of the danger to health likely to arise from overcrowding, every factory employing more than a certain number of hands should also be similarly placed under supervision."

5. Dr. Hewlett, Deputy Surgeon-General, Sanitary Commissioner for the Bombay Presidency, urged, in his Report for 1884—

"I decidedly recommend that the provisions of the Factory Act should be extended to all the small factories and workshops."

6. Mrs. Pechey Phipson, who for seven years had medically attended Indian women, in her lecture, on October 11, 1890, in Bombay on child-marriage, pointed out how greatly natives of India were behind Europeans in physical development, and with reference to the age of maturity in India, declared that—

"So far from Hindoo girls being precocious in physical development, they are much behind in this respect; that a Hindoo girl of 15 is about equal to an English child of 11 instead of the reverse, and that the statements which had been made to the contrary by Englishmen who had no opportunity of becoming acquainted with Hindoo family life were totally misleading."

Addressing the natives of India who were present she said:—

"You say, 'We marry our girls when they reach puberty,' and you take as an indication of that stage one only, and that the least certain, of the many changes which go to make up maturity. It is the least certain, because the most variable and dependent more upon climate and conditions of life than upon any true physical development. No one would deny that a strong country girl of 13 was more mature physically than a girl of 11 brought up in the close, unwholesome atmosphere of a crowded city; yet you say that the latter has attained to puberty and that the former has not. Without going into the domain of physiology for proof of assertion, let me draw your attention to the very practical proof of its truth which you have in the fact, well known to you all, that girls married at this so-called period of puberty do not, as a rule, bear children till some years later, *i.e.*, till they really approach maturity. . . . Does not your own experience bear out the truth of the three following conclusions?—

"1. That marriage under 13 or 14 leads generally to the permanent ill-health (if not fatal injury) of the girl, and to sterility.

"2. That where childbirth takes place at that early age no fresh effort is put forth, and no subsequent children are born.

"3. That, even if marriage is delayed till 14, where conception takes place immediately sterility follows after; but where the girl is strong and healthy there is a lapse of three or four years before child-bearing begins—a proof that puberty had not been reached until then. Of course there are exceptional cases, but does not the consensus of experience point to these as general truths?

"Another disadvantage of premature marriage is that in those cases where the young wife bears children they are puny and sickly. Thousands of still-born children, hecatombs of dead infants, an ever-increasing number of sickly, disfigured, and deformed people bear witness to the results of this pernicious custom. . . . Tell me, any one of you, has it never occurred to you, when you have looked upon your young wife turned into a decrepit old woman through your doing, that she has a right to revile you as the author of all her affliction? Does it never dawn across your mind, as you look upon the sickly boy whom you tend with so much care as the sole hope of your declining years, that, instead of returning your affection, he would be justified in turning upon you and cursing you as the author of his wretched being? . . . For centuries you have been children of children, and there is no surer way of becoming servants of servants."

In the face of such a scathing exposure, and of the opinion of medical men and of common sense, the Government of India maintains that puny, half-grown girls and boys of 14 years of age in India should be considered men and women and permitted to slave in Indian factories for far longer hours than full-grown and well-developed English men and women can work in similar factories in the British Isles without injury to their frame and constitution!

Appendix B.

The effect of reduced Working Hours in Factories.

It has been proved by actual, frequent, and sustained experiments in the United Kingdom, the Continent, America, and elsewhere, that, for both manual labour and labour at a machine, there exists a reasonable limit of hours of labour, with which the maximum effective power of the worker generally corresponds, and that it is senseless, as well as cruel, to work a person beyond these ascertainable limits.

I will first deal with evidence given before the last Factory and Workshops Commission—that of 1875—held in this country, as to the Birmingham industries, which include nearly every process of manufacture outside the textile fabrics. Mr. Arthur Chamberlain, of the great firm of gas-fitters and brass-founders, in answer to the question, "Is there any trade in Birmingham that works more than 60 hours a week?" replied, "I should think certainly not; I should think that no "manufacturer in his senses would hope to get any advantage from

" working more than 60 hours." Sir Joshua Mason, in his letter to the President of the Commission, declared, " The hands under the Act work " 50 hours per week (from 8 o'clock to 6). I have had the carrying out " of the Act in these works since its application, and can testify that the " hands earn as much money, and that there is as much work done as " under the old system of 59 hours."

Mr. Hopkins, wrought hollow-ware manufacturer and tin-plate worker and japanner, in reply to the question, " Do the women only " work from 8 to 5 ? " said, " Yes, only from 8 to 5, and I think they do " as much work up to 5 as they used to do up to 6." Even more telling evidence was given against the system of overwork by Mr. John S. Manton, a button manufacturer, who stated that, after reducing his working time one hour a day his workpeople earned nearly one-seventh more by piece-work in the reduced hours. He told the Commissioners he worked his hands only 48 hours and 10 minutes a week, summer and winter, and said: " We have no overwork. We have found by long " experience that overwork does not pay. Increased hours cause list- " lessness and loss of power, and, therefore, we have abandoned them." So much had this belief grown in the Birmingham district, even as early as 1875, that Mr. Johnston, the Factory Inspector for its southern portion, stated in his evidence that, " The hours of work in summer are, " not uncommonly, 8 to 6, with one hour for dinner from 1 to 2. This " arrangement (nine hours' work a day) is growing in favour with " employers, who find they can get as much work done as in longer " hours, with a saving in steam."

Turning to textile factories, I find in the Report of the Select Committee of 1816 that the celebrated Robert Owen was the first to give a stalwart blow to the devil's doctrine that " the longer you can " work men, women, and children the more you can get out of them." In his evidence he stated that, on reducing the hours in his New Lanark Cotton Mills from 11½ to 10¾ no reduction in the product of yarn ensued. He said, " I would recommend about 10 hours' actual employ- " ment, or, at the most, 10½ hours. My conviction is that no party " would suffer in consequence of it, either with reference to the home or " foreign trade."

Such an enlightened idea was long in making its way into the minds of manufacturers. A fresh stroke in the cause was given in 1844 by Mr. Robert Gardner, a cotton spinner at Preston, who, in that year, reduced the running hours of this mill from 12 to 11, and at the end of 12 months reported that he had got a better quality of work and more of it in 11 hours than he had in the 12. Three years later, in 1847, the " Ten Hours Bill " was passed for textile factories, but it was not until 1867 that the majority of the industries in this country were brought under legal regulation. The cotton operatives were not long in finding that they turned out at least as much product in the 10 hours daily labour as they had before done in the 12 hours; they therefore set to work agitating for a nine hours' day, or 54 hours a week, in which they consider they could do as large an amount of piece-work as they did in 60 hours. The manufacturers, however, were fearful of the possible

consequences, and the 56½ hours a week were agreed to in the Act which was passed in 1874 as a compromise between the manufacturers and the operatives. The operatives soon proved that they could do as much in the reduced hours as they formerly had done. In his evidence before the Gold and Silver Commission, Mr. J. C. Fielden, a Lancashire cotton manufacturer, allowed that in less than 12 months after the passing of the Act "there was not the smallest reduction of produce " from that shortening, even with the same machinery."

Turning to the Continent, we find similar proof that a man, whether tied to a machine or not, is limited by his bodily and mental faculties to a certain amount of profitable work in a day, and that it is senseless, as well as cruel, to work him for more than a certain definite number of hours. Only the other day an account of an experiment with reduced hours of labour by a large manufacturer in Belgium appeared in the " Chamber of Commerce Journal." For three months, as a trial period, this manufacturer reduced his hours from 12 to 10½ a day, and found that this reduction of hours had no appreciable effect upon the production of his factory. At hand-combing the workers did the same amount of work in 10½ hours as formerly in 12; and at machine-combing, which is very fatiguing work for lads, there was a slight increase in production. Many textile factories in Germany have recently reduced their running hours considerably, owing to strikes, and, according to Mr. Oscar Hall, in no case has there been a consequent decrease in production. The reduction of the running hours in textile factories in Austria in 1889 from 12 to 11 and 10 a day, both increased the quantity and improved the quality of the output. Even the reduction of the hours from 11 to eight in the glass works near Dusseldorf, in Germany, after a short time, caused not the slightest falling off in the output.

Only last February, in his speech at Chatham, Sir John Gorst pointed to the great waste of labour in employing men "for unreasonable " and exhausting hours of work." He said:—

"A man who works longer than health and strength allow is wasting his labour, because he is expending his energy and toil when that energy and toil cannot render a proper return. It is most remarkable how you find everywhere proofs that long hours of work, so far from increasing production, actually diminish it. I will give you the last two instances I have come across. In the district of Hesse-Nassau, in Germany, 10 years ago, the glass factories used to work 14 hours a day; they now work 10 hours, and the production in those glass factories has positively increased by the reduction of the hours of labour. In the great linen factories of Plauen, in Saxony, the people work piece-work. They used to work 12 hours, but quite recently the hours have been reduced to 10, and the workmen actually earn by their piece-work more than they did before."

Factory Labour in the Indian Spinning and Weaving Mills.

BY

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[NOTE.—Reprinted from the proceedings of the Demographic Division.]

From a health point of view, factory labour in the Indian mills may be conveniently considered under the following heads:—

1. HOURS OF WORK.

The Indian mills work from sunrise to sunset: the longest days give 12½ to 13 hours of work, and the shortest 11 to 11¼. The *average* of the 12 months is 12 hours 6 minutes and 10 seconds.

The obvious advantage of working with sunlight is that the Indian operative is protected from the impurities in the mill-atmosphere which are generated by the burning of gas in cold countries. Should the English system of 6 to 6 be adopted, gas light will have to be used during some months in the year, and there will be unnecessary fouling of the Indian operatives' mill atmosphere by law.

The Indian operative, moreover, can time himself better by the sun than by the clock, and can avoid going to his mill too early or too late.

However, it would be to the advantage of the operatives in some of the mills in which the masters unfortunately cannot distinguish dusk from dark to have the closing hours, *i.e.*, the hours of sunset during the different seasons of the year, defined by law, as recommended by the Medical Committee of 1884.

The women who form only a small portion (25 °/₀) of the operatives (in England they form the bulk—75 °/₀—of the operatives) and are employed only on machinery driven by the hand with less power than is required to work a hand grind-mill, besides enjoying other special advantages, have special short hours of work, and nominally these are from 7 to 5.30. But they may come in any time between 7 and 9, and leave earlier than 5.30, as they please.

In this, as in many other respects, the women working in the Indian mills are much better off than not only their sisters in the English mills, but also others of their own class in India who work outside the mills harder, for longer hours, and for less wages, as testified to by the mill hands themselves. (*Vide* F. C. Report, 1884, p. 143.)

2. THE RESTRICTION UNDER WHICH WORK IS EXACTED AND THE GENERAL FREEDOM ALLOWED TO THE OPERATIVES.

There are no very strict restrictions. The Indian operative, who is paid by piece-work, is allowed to come in half an hour after time of starting work, as informed by the operatives themselves—the popular notion of sunrise varying within the limits of half an hour. He keeps a lien on his place by putting in substitutes. He can leave early in

the afternoon, if necessary, and get his half-day's wages. There is no rule or way of seeing him constantly at his post during the working hours of the mill. He is a perfectly free agent in that regard. He feels himself at liberty to take his meals between the hours of 7 and 12, to stretch his legs occasionally, to loiter in the compound, or perhaps have his shave and shampoo under little sheds in the mill compound whenever he pleases. The youngsters may be seen having snatches at leapfrog even on the mill premises, and shampooing each other by walking over each other's body, or playing at marbles in the mill compound, a game they invariably indulge in during the recess hour.

The women have more grace allowed them as to their hours of starting work, as already mentioned. Their physical condition obtains for them another grace. During their menstrual periods they are allowed to stay away without giving any notice, and without fear of losing their place. When they have to look after sucklings they have perfect freedom to go to their place and be back at intervals during the day. In fact, the Indian operatives do not work against their custom, or their natural inclinations, or their traditional habits. And it is but natural, for the employers know but too well what a fruitless task it is to go against the traditional ways of the Indian, which have been established by centuries of habit, and which have actually become his characteristics.

3. The Amount of Rest allowed and taken during the Day.

The mill stops work for half-an-hour at mid-day, and that is the recess time when all the operatives stop work simultaneously. But the Indian operative, who will work at his sweet will and pleasure, is to be seen many times during the day outside the mill either smoking his *biddee* or chatting with his friends, and fully 10 per cent. at a time are to be seen enjoying themselves in the mill compound. Moreover, when the mill starts after the mid-day recess, the Indian operative does not hurry in, and nearly 20 or 30 minutes elapse before the working majority are at their machines. Walk through a mill at any time of the day and two out of six operatives told off for sets of machines will not be seen; they take it in turns to be out in the compound. As informed by the operatives themselves, for fully an hour, if not more, they are not actually at work during the day. So that, although he attends the mill for 12 hrs. 6 mins. 10 secs., the Indian operative's actual working hours per day are only 9½ to 10, his cumulative recess of 2 to 2½ hours being made up of the half-hour's grace to start with, plus an hour or more which he considers himself at liberty to spend in the compound, plus half-an-hour's stoppage at midday. The physique of the Indian operatives requires these short stoppages rather than prolonged intervals after long spells of continuous work.

Hardly one per cent. of the Indian operatives take their meals during the recess hours. Each has his own time, and takes it during the working hours, and is not long over it from the nature of his meal. He wants neither forks nor knives, and does not indulge in the heavy breakfasts of his English brethren.

Should it be preferred—and it would be better for the industry itself—to prevent meals being taken during the working hours, two half-hours—one between 8 and 9, and the other at midday—may be given to suit the convenience of the different classes of operatives, and to enable them gradually to fall into the system of taking their meals at set hours.

4. THE AMOUNT OF WORK DONE BY EACH INDIVIDUAL PER DAY, *i.e.*, THE AMOUNT OF PHYSICAL ENERGY PUT FORTH PER DAY, AND THE NATURE OF THE WORK GENERALLY AND THE MANNER IN WHICH IT IS EXECUTED.

Supposing, for the sake of argument, that the production in a mill in India is equal to that of a mill in Lancashire of equal capacity—though, in reality it is somewhat less—the ratio of hands employed in Indian and English mills is as three to one. It will be at once apparent that the Indian operative's total expenditure of energy per day is only one-third of that of the English operative.

Moreover, however much attention may be *required*, it is not in the Indian operative to *concentrate* his attention, and his work is always of an *intermittent* character. "It is in the English mind and muscle to "work steadily and well without cessation when once set to work, but the "Hindu labourer's work is by nature desultory and unsettled." (*Vide* F. C. R., p. 128.) His natural inclinations (for a mind which understands what responsibility is, he has none, though he often shows unusual intelligence in picking up his work and doing it skilfully and dexterously; but dexterous or skilful though he be, he certainly is not laborious) and his muscles are against any continuous work. To expect the mind and the muscle of the Indian operative to work like those of the English mill-hand would be to go against natural laws for the purposes of factory legislation. One might as well think of exacting from a hack buggy horse the spirit, and the speed, and the work of a racehorse. To work the Indian operative continuously, and to get out of him the same expenditure of physical energy, in the same limit of time, as is natural to his English brethren, is to work him to death by exhaustion. The Indian operative wants longer time and many short stoppages to do his work without exhaustion. Short stoppages with short spells of work is natural to the Indian. Ordinary laws of physical exercise tell us that it is not so much the length of time taken to do a given work, as the intensity of energy put forth to finish it within shorter time that brings on exhaustion, and a longer interval of rest afterwards is but a poor make-up for the effects of exhaustion, for exhaustion makes its demand upon the reserve stock of energy. It is like living upon one's capital and not on the interest the capital yields. Exhausting work is not economical work. But it is more than that, it is killing work, for it acts like a poison. Physical work means combustion in the muscles. The products of combustion act as poison when their dose exceeds the degree of tolerance natural to each individual. The dose is readily exceeded to a

greater or less extent when there is more than the usual expenditure of physical energy in a given time. The feeling of giddiness, with prostration and aching of muscles, which is experienced after a run to catch a train must be familiar to many. The falling down dead of horses after an unusual gallop is another familiar example. A slight daily excess of the usual expenditure of energy would ultimately act like a slow poison, and like other poisons, the poison of exhaustion not only leads to deterioration of physique but points to an early grave. That this is the fact, and, moreover, that it is not so much the number of hours over which a work is spread, as the nature of the work and the actual amount of physical labour involved that tells upon the health of the labourer is proved to demonstration by the declared experience of the dockyard authorities (*vide* F.C.R., p. 172), viz., that the men in the dockyard (who, by the way, possess originally better physique than the mill hands) whose longest hours are from 8 a.m. to 5 p.m., and who get four Sundays and other holidays in each month, wear out in a very few years by ***being kept at work as hard as a European would work himself. The natives cannot stand this, and break down and die.***

5. The Number of Actual Holidays in a Year, and the Period of Absence from Work during a Month.

Often enough substitutes will be put in and the mill-hands will take formal holidays on private affairs, personal, religious, or social. Not even 5 per cent. attend the mill all the working days in a month; not one attends as many as 300 days in a year. The number of holidays taken are, therefore, twice as many as are nominally allowed. They should have four days in a month, and a few extra holidays, and probably they may then not want to give themselves so many holidays for private purposes. But the number of Native holidays is greater than that of the Christian, and the Indian operative will actually be getting more holidays in the year than his fellow-worker in England. It has already been pointed out that women stay away each month any period of a week owing to the recurring illness peculiar to their sex, so that, with the 60 odd general holidays, their holidays in the whole year will show a grand total of over 100.

6. Periodic Change of Work and Visits to the Country.

The Indian mill operative, like most of the work-people, belongs to an agricultural class. Most of them have family plots of land which each one must take his turn to till. There is a common family income, and the earnings of the mill-hands go towards bettering their property in the country. Every year, or at least every two years, the mill operative will go to his *mooluk pani* for two to four months. In fact, like the Anglo-Indian, he has furloughs. He keeps a lien on his appointment by putting in a substitute. He is much better off in this regard than an office clerk. From a health point of view, the Indian operatives have this immense advantage over their fellow-workers in England, who are settled to the districts they work in.

7. The Sufficiency or otherwise of Wages.

That the mill-hand earns on the average considerably more than a labourer outside the mills is shown by the evidence of the mill-hands themselves. The earnings of a jobber who knows not how to write his own name come to more than Rs. 70 per month, and might well be coveted by the clerical class. Husband and wife or wives and children bring in a very handsome sum, which enables them to obtain far better food and clothing, and even luxuries, one of which unfortunately is drink. The mill-hands can be easily distinguished from others of their own class who work outside the mills, and from other labourers generally by their better appearance, their better clothes, by the amount of jewellery (gold and silver) on the persons of the females. The English artisan has a higher standard of comfort and enjoyment of which a Hindu, even with 500*l.* a year, is in blissful ignorance. The Indian operative knows no furniture beyond a box that contains all his valuables. He wants no chairs, nor tables, nor table-covers, nor knives, nor forks, nor spoons to eat his meals with. His tailor's bills are not heavy. Milliners have no existence amongst them. Pantomimes and plays and picnics are of a very crude nature, and cost next to nothing. The Indian operative has no high rent to pay for his chawl room, which may be about 10 feet by 15 feet, and admits light and air through the only entrance into it—by the doorway; and the wonderful little room serves as kitchen, drawing-room, and sleeping-room at different hours of the day. Ventilation is a thing the Indian labourer does not understand. In point of light, ventilation, and breathing space, the mill he works in is much superior to the chamber he lives in. So that when he takes his meals in the mill he does so under not unfavourable circumstances.

8. The Conditions of Temperature, Atmospheric Moisture, Ventilation and Light.

i. *Temperature.—a.* The Indian mill-hand is an inhabitant of a warm climate, and belongs to an agricultural class that works in the open fields from sunrise to sunset, in all weathers, with a temperature ranging from 110° to 160°. The mill temperature of 95° is certainly less than what he is used to, and, moreover, he is protected from the direct heat of the sun. Many of us work with 95° in our offices during the hot months. The climate is such that in spite of the high temperature the weather is not oppressive. The mill-hand has next to no clothing on him while at work, and, according to a physiological principle, he does not feel uncomfortable in the hot mill, his skin gettting more active to counteract the effects of his warm surroundings. Temperatures of 50° and under would be as unnatural to him in idea and actuality as those of 95° and over are to the uninformed and hysterical westerns. It is, moreover, a fact that the attendance is more regular, and the sickness less during the hot than the cold months.

b. There is not that kind or degree of difference between the mill and outside temperature in India that is to be found in cold

countries, and this serves as a natural protection to the Indian operative from the inflammatory affection of the lungs to which the English operatives often fall victims from the sudden and considerable change in the air that they breath on leaving the hot rooms of their mills. The Indian operative can be in and out of his mill all the year round with impunity. The temperature of the reeling room in which the women work is not at all raised.

ii. *Moisture.*—The mill atmosphere in India is free from that degree of moisture which is imparted to the mill air in England from the use of steam all day long. The Indian operative breaths, therefore, a purer atmosphere as regards the degree of moisture, and this is a further natural protection to his lungs.

iii. *Ventilation.*—It will not be disputed that the Indian mills are more lofty and capacious buildings giving more breathing space per individual than the generality of English mills. Means for ventilation exist but are not properly utilised, owing to the habits of the operatives themselves. It is a peculiar habit with the Indian operative that he *will shut* the windows when he can. He will have any amount of heat but no draught, and the latter he dreads so much that he will shut all the windows as a precautionary measure, as he thinks. It is a common experience to find servants preferring to sleep out on the verandah to indoors with windows open. Should indoor sleeping be insisted upon every window and shutter will be most sedulously shut. To prevent the mill-hand frustrating all means of ventilation, the mill owners should adopt the suggestion of the Medical Committee of 1884, that the openings for ventilation should be placed beyond the control of the operatives themselves, and under the sole control of the manager of the mill, or of his immediate assistants.

iv. *Light.*—The Indian operative has again the immense advantage of the Indian sun, and the sun is so essential for the health and life of all creation. Sunlight does away with the harmful effects of artificial light, and all labour work in India is universally done by no fixed hours, but from sunrise to sunset, there being longer days of work in summer than in winter. It is thought prudent not to sacrifice the natural advantages of sunlight, but to conform to the natural conditions of the country, and even to work according to a system of irregular hours according to the seasons of the year, rather than to have a sentimental uniformity of hours all the year round.

9. The Habits and General Condition and Life of the Class of People to which the Mill-hands belong.

As already stated they belong to an agricultural class, and the districts they come from are very liable to suffer from famines. To begin with, they do not possess in their districts any of that very well developed physique or stamina that is peculiar to the hill tribes generally, to the Purdasee and Navganee classes. They come to Bombay to earn wages which will not only maintain themselves, but also their families and their relations in their districts. The mill industry has not only

helped them out of the difficulty, but has provided them with the means of improving the condition of their districts generally. Only recently a Government resolution declared that the condition of the districts they come from has been ameliorated by the mill industry of Bombay, the periodic famine difficulty being not experienced as of old. With the general habit in India, even of the Anglo-Indian, the mill-hand rises early—and so does his whole household: men, women, and children—and prepares himself to start for his mill, which is, perhaps, a mile or two from his chawl. The Indian climate makes his walk to the mill pleasant, if anything, and he is all the better for his little fresh air exercise. Arrived at the mill he changes his clothes, and spends the day as already described. At the approach of sunset he prepares himself for his homeward journey, changes his clothes, sees to his brass pots in which his meal was brought to him, and looks out for the first slackening in the speed of the machinery, when he slips the strap on to the loose pulley, and makes for the main gate, after having apparently worked for a 12 hours day. On reaching home he goes through his necessary ablutions, and partakes of his evening meal. Then he amuses himself by chatting with his friends and neighbours, or more often joins in the musical tom-tom party, which does not break up till midnight. On his holidays, the tom-tom party—the drinking party—and the acrobatic feats party is kept up till he has thoroughly tired himself, or, as he thinks, enjoyed himself to his heart's content. The bulk of the operatives do not work at the mill all their lives, and hence it is that the per-centage of old operatives in the mills is small, but the jobbers and muccadums, who enjoy handsome incomes, keep to their posts, and several of them, whose ages vary from 45 to 60, have seen more than 30 years' service.

10. Their Physical Condition as revealed by Medical Examination and by Hospital Experience.

The Report of the Medical Committee of the Factory Commission of 1884 most distinctly lays it down that mill operatives do not exhibit any material deterioration in health or condition, and that this fact is arrived at by physical examination, and is also supported by all that could be gathered as to their health, from the amount and nature of work, from appearances, &c. of the operatives.

Without going into detail it might briefly be stated that a great many operatives were examined during different visits, and they did not show signs of a breakdown in health or physique; *the women were found to be particularly healthy and strong* as compared with women labourers outside the mills. This information was further confirmed by personally inquiring into the history of each of the operatives examined; all the old operatives of 50 to 55 years of age, were constantly at their posts; all they suffered from now and again was malarious fever for a few days. It is well known that life is shorter in India by 10 to 15 years, and an Indian operative of 50 may well represent one of 60

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and over in England. In the J. J. Hospital, the largest hospital in Bombay, where all classes of labourers, amongst other people, are admitted, I have not, as a physician, had to treat a single mill-hand within a period of three years. Very few, indeed, have to seek hospital relief, and such as do have to do it are surgical cases, and what has been the experience of our Chief Surgeon, Dr. Gray, who, by the way, was also on the Medical Committee of 1884? "The mill-hands are the best "class of patients; they bear operations well; their progress in the hospital "is satisfactory; their wounds heal quickly; and their recovery is "rapid." It is healthy wounds that do well and heal rapidly, and healthy wounds require healthy flesh and healthy blood, and healthy flesh and healthy blood can only belong to a healthy and well nourished body. This one single fact more than any other truly tells the condition of the Indian mill-hand, and ought to soothe and settle at rest the troubled minds and hearts of mistaken humanitarians.

The conditions of factory labour now gone into refer to the operatives of the large spinning mills that work all the year round. Most of the quotations of Mr. Holt Hallett refer to the ginning factories, which are dotted over the cotton-growing districts, and work only for a season in the year. And, although the work is sometimes hard and the hours long, the natural instincts of self-preservation prevail, and the remuneration that a season's work in the ginning factory brings is more acceptable than the semi-starvation which would ensue without it. The operative knows his own feelings, and this is how he expresses himself:—"We earn enough in three or four months to keep us the "rest of the year; when the season is over we return to our villages "and live well till the next season begins."

There is no parallel case of such factories in England, and it is doubtful if the English factory laws would have been applied to such factories without modifications to suit the different circumstances and conditions of work in them.

But here it must be pointed out that Mr. Holt Hallett's quotations are misleading, even in the case of these factories, for the harrowing tales are told without giving the facts, which in a great measure tone down the apparent hardship of the 23 out of 24 hours' work.

Mr. Drewett says:—

"The women are allowed to go in and out of the factory just as they like, and their relations come in and relieve them and enable them to rest, for even three hours at a stretch. The women sit on the back of the gins, and have simply to lift up the cotton and push it forward. I have often seen them do this mechanically, three parts asleep. *There is very little dust in these ginning factories.* I have known many cases where the hands have broken down from overwork. I have frequently heard of their going away sick, but I have never heard of their death. I myself have worked day and night, without sleep, but I have never been ill through doing so. The women have worked 23 out of 24 hours. *Of course in speaking of 23 hours I mean that the woman*

was relieved by her friends or relations. The women prefer to do night work to going home. The people are so poor that they are glad to get work at any price, although a number of them frequently break down from overwork. This is the *lightest* work they can get, and they prefer to break down from overwork than from starvation."

Factory labour, however, in the small factories which work nearly all the year round, such as the wool-cleaning, bone-crushing, and similar other factories, needs regulating, especially with regard to their sanitation.

It will be observed that in this paper no stock has been taken of abstract figures. Figures are deceptive articles. They may be permuted and combined to strike the imagination one way or the other, and to build up fictions of enormous magnitude.

It has already been seen what 13 hours of work in the Indian spinning mills means in reality, and what the small number of printed holidays really means in practice. The armies of the native States show a very striking figure as regards their number, but the figures indicating their numerical strength have not overawed Government, nor have Government been forced to increase their standing armies by imaginative sensationalists, because of the vastness of the armies in the native States; for, thoughtful and practical men know that the numerical strength does not represent their fighting capacity. Let Mr. Holt Hallett study the actual facts and make himself and his friends conversant with the peculiar condition and the circumstances of the problem, and not be simply overawed and alarmed at the large figures which he has been at some pains to extract, and not build up statistics which have no actual existence in the country he ascribes them to.

No attempt has been made in this paper to appeal to sentiment or imagination, or to theoretical considerations, but the solid facts, as gleaned from personal observation and inquiry, and from the everyday experience of Indian life, are put forth for the consideration of practical and thoughtful men, and an appeal is made to their reason and sober judgment. Identical laws can be applied to identical conditions. Are the conditions in India and England identical? Most emphatically not. Already the factory laws have thrown out of employment the little operatives they tried to protect and benefit, who are no more the well behaved, well fed, well clad, and well cared for little persons they were before the shadows of the Factory Act were cast upon them. Will the English factory laws better, in any way, the condition of the women, who form only a small portion (25 per cent.) of the operatives, and who work comfortably in the cool and capacious and airy rooms of the Indian spinning mills, with special freedom, both as regards their hours of work and their attendance at the mills?

As has already been shown, the application of English factory laws to Indian mills would mean ignoring the natural conditions of the country and its people. It would mean rejecting the advantages of the Indian sun, and preferring gaslight to sunlight. It would mean forcing

the Indian operative, by law, to breathe impure air, for his friends in England wish that he should work with gaslight just to have uniform hours of work all the year round, as in Lancashire. It would mean forcing the Indian mind to think like the English. It would mean forcing the Indian muscle to work like the English, no matter what natural laws with regard to work done by individual muscle may teach. It would mean killing the muscle of the Indian, and with it his whole frame, by a process of slow poisoning from exhaustion. But, if the Indian muscle cannot give the work of the English muscle, more hands will be required to keep up the production, for the industry will have its life and growth in spite of factory laws; and, this will necessitate reduction in the wages of the Indian operative. This will mean reducing the Indian operative to semi-starvation with the protective application of the English factory laws to Indian mills. Thus, the importing of the benign and protective factory laws of England into India would mean killing the Indian operative, either by the slow poisoning of exhaustion, or failing that, by the equal certain process of semi-starvation. Their application to Indian mills is simply ridiculous, absurd, unnatural, and cruelly mischievous. Mistaken kindness from ignorance is often productive of mischievous results, which make the very hearts which are brimful of kindness recoil with horror, and curse the ignorance and the mistaken enthusiasm which called forth their philanthropic palpitations without any warrant. I feel certain that when they have well digested the facts, and have allowed time for the exercise of their judgment, Mr. Holt Hallett and his mistaken humanitarian friends will halt, and change their course altogether. They will, with better knowledge, denounce every attempt at introducing the English factory laws into India. And Mr. Holt Hallett will be the first, now that he is in possession of the true facts, to come forward to exercise that noble privilege of every truth seeker, to acknowledge his mistake and his misconception; and, moved as he is by humanity and philanthropy, to embrace this magnificent opportunity of doing by his reversed action, so to say, incalculable good to the Indian labourer, whose cause he has espoused, but whom, from not knowing fully, he was in the imminent danger of killing by kindness. But the advocacy of Mr. Holt Hallett and his friends and supporters *against* the introduction of English factory laws into India will have quite another far-reaching beneficent influence. It will increase the class of once discontented poverty-stricken ryots now happily changed into contented and loyal artisans, and thus materially advance the stability and the fame of the humane British rule in the Indian Empire of Her Most Gracious Majesty the Queen Empress; and last, but not least, it will establish beyond cavil the soundness and wisdom of the principle embodied in the pregnant remark of Lord Salisbury, that there should be no "unnecessary, hasty, and mischievous interference" on the part of the home government, even at the instance of well-meaning but uninformed philanthropists.

DISCUSSION.

Surgeon-General H. Cook, M.D., F.R.C.P., said:—Although the time allowed for speaking is very limited, it will be of advantage if I state by what authority I rise to speak, or what gives me this authority. I have been 30 years in India, some 15 years in the city of Bombay, and during that time many years as Principal of the Medical College and Chief of the Staff of the Government Hospital of Bombay—the Jamsetjee Jijibhoy Hospital,—having 500 beds, and I have for many years taken great interest in the working of the municipality. I had not intended to speak to-day, but should the statements made in Mr. Holt Hallett's paper stand uncorrected they would reflect very seriously on the humanity of the medical profession in Bombay, on that of its chief citizens, and on the Government. I am extremely sorry that so valuable a paper on this important question should have been so greatly disfigured by exaggeration. Dr. Bahadhurji has just stated what are the real conditions of factory labour in Bombay, and has explained the peculiarities which characterise native labour, so that I need not say anything regarding the actual hours of labour; but I would like to support his general statement that although in Europe it may be the "pace which kills," it certainly is not so with the Indian operative; in all occupations he takes his time, with frequent periods of rest, and varies his work with relaxation. His occupation is not one of caste—going down from generation to generation, and thus increasing the evils of the system, and perpetuating by heredity the ill results of possibly irregulated labour. He comes from his up-country village to make money to pay off his debts, and thus, at any rate, to share in the much higher-paid labour of the city, and when he has had enough of it he retires again to his village. The conditions under which he works in the mills as regards temperature and ventilation would undoubtedly be considered inconvenient, to use a mild expression, by the European visitor, but they are congenial to the native who works best under high temperatures as compared with cold and chill, and who above all hates ventilation. Not that I am defending this, but merely stating a fact. I have often passed, whilst driving through Bombay, crowds of operatives thronging out of the mills at dusk, and they certainly have not the exhausted worn-out appearance depicted in Mr. H. Hallett's paper. They by no means look the "driven, bullied, and beaten" slaves he describes, but a throng of able-bodied operatives—laughing, singing, and chatting with rapid if not boisterous action, hastening to their homes in the enjoyment of release from labour, and the picture by no means represents a mass of "wretched beings, scrambling for work at any price, "and knowing nothing of the real pleasures of existence." But, although I do not agree with Mr. Holt Hallett that it would be wise to force the hands of the Government of Bombay, and to insist on the introduction of an Act assimilating labour in the mills there to that of those in England, I certainly do think that the smaller workshops and factories should be brought under surveillance and regulations. It is notorious that the native of India hates ventilation, and will stop if he can every entry of air, be it door or window, and do his utmost to render the air as stuffy as he can make it; and the ventilation, cubic space, and sanitation of those places should be efficiently regulated.

The Hon. N. N. Wadia, C.S.I.E., A.M.I.C.E., said:—It would not be possible, within the short time at my disposal, to fully reply to the several points raised in Mr. Hallett's paper, a copy of which has just

been placed before me. I fully endorse what has fallen from previous speakers, and more particularly I would draw your attention to what has fallen from Dr. Cook, who I am glad to see here, and to know that he still takes an interest in the Presidency in which he was for many years one of its leading physicians, more particularly so in Bombay. No man had better opportunities and better scope of judging the condition and physique of mill operatives, than he had during his long practice, and I think his experience ought to be accepted in preference to the second-hand statements made by Mr. Hallett, which are vague, and, in many instances, unfounded. If the sensational picture drawn up by Mr. Hallett were true, no doubt there would be strong grounds for a change, and I am sure that no Government would be more ready than the Indian Government, and more particularly the able and wise statesmen who have its direction at present—Lord Lansdowne, Lord Harris, and other Governors—to deal with the question adequately. But India is essentially an agricultural country; three per cent. only of the population are employed in manufactures. Legislation in a country whose industries are young, has to be cautiously introduced; and I can assure Mr. Hallett that the subject has had the most careful attention of the various Governments within the last 10 years; and the Act which is to come in force in 1892 is the outcome of a long and careful series of inquiries made by a Commission; and it is upon their recommendation, after mature consideration in supreme Council, that the Act has been moulded as it now stands. England can well afford to leave to the judgment of such persons as now hold the reins of the Indian Government legislation of this kind in India, in preference to the wild and vague statements now laid before us. If Mr. Hallett, as he states, is interested in the welfare of our operatives, is desirous of helping and promoting their welfare, the best thing he can do is to come out to India, stay amongst us, and learn, not from hearsay, but from practical knowledge and experience, what are our wants, and then I feel sure if he is actuated by the motives which he has placed before us, he will come to the conclusion that the lot of the Indian operatives is not so hard as he pictures it; but that, on the other hand, the operatives in the textile industry are far healthier, far better fed, and in better physique than their fellow men employed elsewhere. And no other evidence is necessary than the fact that mill employment is sought and coveted in preference to anything else. I can assure Mr. Hallett that if he does favour us with a visit he will have every opportunity and facility afforded him of arriving at a true conclusion.

Mr. R. Hamilton, as a former resident both in Bombay and in Calcutta, in favour of the representation of Dr. Cook, Dr. Bahadhurji, and others who had spoken from practical experience, would only refer to the experience afforded by legislation in this country. In 1803 a very well drawn Act was passed with many excellent provisions both for the regulation of labour and for education. No objection whatever was raised to its provisions; but the preamble of the next Act in 1833 stated that no action whatever had been taken under the former law. This new Act gave large executive powers to inspectors to make and enforce regulations. In 1844 a further Act was passed withdrawing all these powers and confining the duties of inspectors to inspecting and reporting. Then, for the first time, real work began; by means of much incessant and patient labour, improvements were gradually introduced, and the employers of labour were led to co-operate with the inspectors and to second their efforts in the most practical manner. If this method holds

good in England, much more will it do so in a country where the population is so essentially conservative and averse to changes. He feared the sweeping and indiscriminating charges of Mr. Holt Hallett would do more to obstruct than to advance the objects he had in view.

Dr. Albert Siffingwell referred to his own experience during a visit to Bombay, and his impressions of the character of the working-class population. He visited the mills of Bombay in 1881, and during much observation of poverty-striken factory operatives in various parts of the world, he never saw a more downhearted and apparently overworked class of working men, women, and children. Forty years ago the same argument now used against legislation in India, were again and again presented in Parliament against any curtailment of hours for labour of children in English factories. Then it was argued that no legislation was required for England, that it would ruin English industries, and the same argument is advanced in favour of Indian industries now.

Mr. Holt S. Hallett, in reply, said:—The question is whether the natives employed in Indian mills are to be left to the mercy of the manufacturers or protected efficiently by such legislation as will prevent any cruelty to the operatives. All present must allow that there may be good manufacturers, but there certainly are bad mill-owners who will squeeze all they can out of their mill hands. The report of the last India Factory Commission does not reflect a pleasant picture. It was found to be the rule that little children of 8, 9, 10, and 11 years of age are worked for as many hours as the men, although by the Factory Act of 1881 such children were restricted to nine hours' work a day. As to the intervals granted in the Indian mills, the report of the Commission proves that the single recess in the Bombay mills is only an average of 15 minutes, and that the hands are only allowed out of the mill besides for one or two intervals of a few minutes. As to the hours of work in the Bombay Mill, the Factory Commission of 1884 gives them as varying between 11½ hours in the cold season, and 14 hours in the hot weather. The Commission of last year gives them as 12, 13, and 14 hours. As proof of the accuracy of these statement, I may refer my hearers to a blue book on Indian Factories, published in 1888, giving recent reports of Indian Factory inspectors. In this report there is a table in which the hours of starting and stopping machinery in an Indian mill are shown for each month in the year. It is there shown that in January the engineers start at 5.50 a.m. and stop at 5.50 p.m., and that in June they start at 5 a.m. and stop at 7.15 p.m. No one who has studied the reports of the Bombay Factory Commissions of 1875 and 1884, and of the Commission of last year, and the reports of India factory inspectors, with an unbiased mind, can fail to allow that every statement made in my paper is amply borne out by the evidence.

An Analysis of Mr. Holt Hallett's paper on Factory Legislation in India.

BY

K. N. BAHADHURJI, M.D.

On reading Mr. Holt Hallett's paper, one cannot help noticing that no allowance is made for the different conditions of labour in the different factories. There is, therefore, much confusion of ideas, and the real truth is lost in a mass of conflicting assertions and sensational recitals of what are put forward as facts. The questions which suggest themselves to an ordinary truth seeker and which require exact answers are these :—

1. Does Mr. Holt Hallett consider the term "workers" a definite one? Does he really think that 8,000,000 females work in the Indian mills and factories and workshops? Does his summing up of the number of females employed in the cotton spinning mills, towards which his attacks are principally directed, show enormous totals?

2. Has he himself actually seen, or even heard of any "babies in arms" working in any mill or factory in India, or for the matter of that anywhere on the surface of the earth, and that for any number of hours, night and day?

3. If he has, by what physical laws does he account for these prodigies of babies being the offspring of his "puny overtasked Indian "workers who have only one-fifth the stamina of the English labourer, "and who toil in dark and unwholesome dens"?

4. Does he know how much of the physical ailments he describes is due to the insanitary conditions of the "chawls"? Has he been inside any of these chawls? Which is more unhealthy—to sleep in the chawl rooms, or to work in these factories during the day, where one can go out at intervals to breathe fresh air? Does he know what ventilation means to the mind of the Indian operative?

5. Is he aware that improvement in the sanitation of the small factories by legislation is not only welcome to his "bloodthirsty and inhuman" Indian mill and factory owners, but actually courted by them? How did this fact happen to escape his eye when studying the Factory Commission Report of 1884?

6. Mr. Thomas Drewett, who knows what ginning factories are, and who is quoted by Mr. Holt Hallett distinctly says, at page 175 of Factory C. R. of 1884, that there is *very little dust* in the ginning factories. By what process has Mr. Holt Hallett manufactured these words into "*the air is choked with cotton dust and fluff*"? Does he moreover imply that the work in the ginning factories is extremely arduous? Why does he not accept the fact studied by him and quote Mr. Drewett, who knows that the work is of the *lightest nature*?

7. How did he come to know of children being employed in the ginning factories? Is it a mere story he has heard, or believes to have heard?

8. What is this "abominable cruelty of working lads, girls, women, and children, day after day for 23½ *hours at a stretch*"? Does one's common sense and simple knowledge allow one for a moment to believe in the possibility of the existence of such a cruelty, much less to repeat such absurd and impossible stories?

9. Mr. Holt Hallett quotes Mr. Drewett about the 23½ hours of daily work. Mr. Drewett, however, says, "of course in speaking of 23 hours—" (not 23½ hours, as Mr. Holt Hallett quotes)—I mean that the "woman was relieved by her friends or relations, and the longest "interval she may have is of two to three hours." By what process does Mr. Holt Hallett manufacture the believeable and unvarnished fact of working for 23 *hours with some rest intervals of as much as 2 to 3 hours* during which friends and relations come in as relays, into the absurd and revolting story of *working day after day for 23½ hours at a stretch?*

10. Mr. Holt Hallett charges the Factory Commission of 1884 with being largely composed of persons interested in Indian factories. Does he do so from actual personal knowledge, or from his own peculiar knowledge and ways of presenting facts?

Is he not aware that of the 11 members of the Commission, eight were of the independent class?

11. Does he really mean to assert that young persons keep standing for five hours a day at a machine? Is it physically possible for young persons 9 or 10 years of age to do so?

12. Is he aware that flat foot is common enough in people who go barefooted? Would he not accept the experience of medical men, who can speak from knowledge of the present mill hands, that knock-knee is by no means very common amongst them?

13. In doffing is there much physical strength or constrained position required?

14. How many months in the year give 14 hours of light, enough for work from dawn to dusk? Can he cite many mills which have worked for 14 hours? Does he know that it is the hottest season of the year in which the Indian operatives are most regular in their attendance and in better health in spite of the longer hours of work? Does he in all seriousness urge that heat is unnatural to the Indian workman because the English workman cannot bear it so well?

15. The 5 a.m. to 8 p.m. hours of work for women obtain chiefly in the ginning factories that work only for short seasons. Why should these be mixed up with the 8 a.m. to 5 p.m. hours of work in the spinning mills?

16. In the age we live in, with so much night travelling and so many other cases of persons on night duty, would it be natural to say that night work is contrary to nature?

17. What source of information could it be that speaks of fatal heat apoplexies amongst the Indians? Is it that the men, women, and children who work in the open fields under the burning rays of the sun are seized with heat apoplexy when they don't sleep at night? Will Mr. Holt Hallett enlighten the medical world on the nature of night heat apoplexies amongst the Indians?

18. Is age the sole factor to be considered from a health point of view? Is not nature of the work a most important element to be considered in reference both to age and hours of work? Are the children who work in the fields all day and earn next to nothing, or those that loaf about in the streets in a semi-starved condition and crowd the reformatory institutes, better off than children who do a little actual work in most cases in company with their parents or other relatives, throughout the day in the mills, and who earn enough to enable them to be better fed, better clad, and better cared-for?

19. No doubt the Indian operative is deft with his fingers. But does that imply that he is laborious with his muscle and his mind?

20. What analogy is there between the English and Scotch artizan, on the one hand, and the Indian on the other? The Scotch does not make the best spinner and weaver, as the English does, simply because he is not so clever and deft; and though the Scotch may not have the deftness of the English artizan, certainly he has his muscle. Has the Indian operative the muscle of the English or the Scotch, though he may have the deftness of the former? Does deftness mean muscular power or physical force or is it something very different?

21. When Mr. Holt Hallett speaks of the Indian operative as ill fed, does he do so from personal knowledge and observation? Did he not learn exactly the contrary from the words of the operatives themselves recorded in the Factory Commission Report, which he is supposed to have studied? Is he similarly informed when he speaks of the Indian operatives being more wretchedly housed than workers outside the mills? Is it any analogy to compare the work of a child with that of an adult? The Indians who "have one-fifth of the stamina of the English," during their pilgrimage do their 20 to 30 miles a day without exhaustion in their natural way of making journeys with frequent short stoppages all day long. They cannot do it like the English who make long journeys with less frequent but longer stoppages; nor would a long rest afterwards enable them to get over their fatigue. And is not this in accordance with the natural physical laws of work and energy?

22. Does Mr. Holt Hallett want us to believe that he can study the conditions of labour in India by reading the reports and opinions in his own peculiar way, better than the Government on the spot, whose statements he challenges?

23. Mr. Holt Hallet makes great capital of his own extracts from the Factory Commission Report of 1875, and ill-uses the Report of 1884, as shown in questions No. 6 and No. 9.

Does he want to legislate for the India of 1875 or of 1890? Does he think that India has not progressed since 1875?

24. Where did he read of inflammation of lungs and air passages being common in mill operatives? Does he see so much more of it from a distance of thousands of miles than do the medical men on the spot from personal observation? Where did he learn that the mill operatives suffer from stomach derangements more than other classes of labourers in India?

25. Has he seen his "wretched mill operatives exposed to the "inclemency of weather in the open air for the *remainder of the night*, "whilst waiting for the door to be opened at day-break"? If one gets up even at 3 a.m., he takes time to cook his food and walk down to his mill. He cannot be at the mill till after 4.30. Day-break is at 5 o'clock. What does Mr. Holt Hallett mean to convey by picturing the interval between 4.30 and 5 a.m. as the "remainder of the night"?

26. Why does he want the factories to be heated with steam in the hottest season of the year? Whence this unique experience?

27. Not one operative, except the jobbers, works quite 300 days in the year, and does not go to his native country every year or two for a month or longer. With this knowledge in his possession, for he must have studied the reports, by what process of logic and according to what canons of truth did he undertake to assure his hearers that the Indian operative is denied all time for recreation and domestic happiness?

28. Was the knowledge which he must have derived from a study of the reports as to the physical condition of the mill operatives, quite forgotten when he was drawing the harrowing picture of his "puny, overtasked" labourers in the "dark, dirty, dusty, overcrowded, unwholesome dens" of the Indian mills.

29. He may be acquainted with the history and results of factory legislation in England. Does he seriously want people to believe that he is equally acquainted with the history and results of factory legislation in India?

30. Does not Mr. Holt Hallett know that the industry itself, if at all affected by factory legislation, will be affected for the better; but it is the operatives who will suffer from any indiscriminate application of English factory laws to all conditions of factory labour in India.

31. Is it not due to "ignorance of facts, and to the consequent continued belief in the long since exploded pleas" of uninformed humanitarians, that facts happen to be distorted, and even accusations recklessly made against the Indian Government of having their "Councils dominated by capitalist interests?"

32. When Mr. Holt Hallett quotes the opinion of medical men, why does he omit to quote the very first paragraph in the report, which distinctly lays down that the Medical Committee did not find any deterioration of physique or health of the mill operatives as compared with that of labourers outside the mill?

33. Is it because it is diametrically opposed to his picture of the "puny, overtasked, &c., &c.," operatives?

34. The medical opinion is quoted apparently to have the hours of work in the Indian mills shortened. But, indeed, does *defining* the hours (so that people's life and limb may be safe by not working in the dark, as distinguished from dusk) mean *shortening* them? Does defining mean shortening in any case? (I may add that I am acquainted with the Medical Committee personally, and know their views on the subject to be distinctly against shortening the hours.)

35. Mr. Holt Hallett must be aware that Dr. Mrs. Pechey-Phipson, whom he quotes with satisfaction to support his views, repudiated *in toto* the conclusions Mr. Holt Hallett sought to draw from her writings and public utterances? Was it fair to have kept his audience in complete ignorance of this important fact?

Does he mean to assert seriously that he knows better than Dr. Mrs. Pechey-Phipson what she means by her own writings and public utterances?

The Suitability of Tropical Highlands for European Settlement.

BY

Surgeon-General Sir WILLIAM MOORE, K.C.I.E., Q.H.P.

[NOTE.—This Paper is reprinted from Volume X.]

The value of life in a tropical climate, especially that of the lives of Europeans who remain there, is less* than the value of life in a temperate climate. The reasons are patent. First, there is a direct depressing effect on the nervous system from continued heat.† Then air, expanded by heat, must contain less oxygen in a given bulk,‡ so that less oxygen is inspired. It is also rendered less elastic, and therefore less fitted to dilate the chest. Respiration is slower in a tropical climate when the person is at rest,

* The French authority, Michael Levi, states that from the equator to the 20th degree of latitude there is one death annually in 25 inhabitants; from the 20th to the 50th degree 1 death in 35; from the 40th to the 60th degree 1 death in 43; from the 60th to the 80th, 1 death in 50. Dr. Machonachie, the oculist of Bombay, has remarked on senile degeneration, especially of the eyes, occurring sooner among natives than in Europeans. And it has been shown that the average number living at each age-period in India, as compared with England, is altogether in favour of England, after the age of 50.

† Even in a temperate climate a season of extraordinary heat causes languor, debility, and indisposition to exertion by the depressant effect on the nervous system.

‡ 1,000 cubic feet of air at 62° F., when raised to 82°, occupy 1,038 feet.

and it is not so much accelerated by motion and exercise,* to which the individual is usually less inclined. From such causes less oxygen is introduced into the system. Want of oxidation leads to the formation of fat.† The red corpuscles of the blood become studded with particles of a fatty nature,‡ which impair their function of carrying oxygen.§ All this results in a lessening of expired carbon.|| There is also, especially in the hot season, as a consequence of increased sensible and insensible perspiration, a diminished secretion of urine, so that there may not be sufficient fluid to dissolve all the effete matter which should be excreted in the urine. This, again, results in the retention of material which ought to be excreted. Such materials represent the ashes of a furnace, and the emunctory organs the bars. If ashes remain the purity of the flame is affected. And so it is in the human system. The result is the condition often mentioned as "malarious cachexia," but which is really *anæmia*, meaning impairment and poorness of blood. When the blood becomes impoverished the brain becomes irritable. "The reason calm, the temperate will, endurance, foresight, strength, and skill"—all qualifications for a successful colonist—are reduced to a minimum. It is true that other organs, especially the liver, are excited to increased action whereby some effete matter is expelled. But increased liver action is usually followed by torpidity, torpidity by congestion, and congestion by hepatic deposit, with all its train of evils. There is also another important consideration. Owing to the constant action of the skin induced by heat, this organ becomes extremely sensitive to changes of temperature. A fall of a few degrees in the tropics, makes a greater impression than a fall of many more degrees in a temperate climate, where the skin is not so sensitive, and is protected by thicker clothing. The European in the tropics is, therefore, excessively liable to chill; and chill originates a large number of maladies, certainly favouring, if it does not cause, the fevers of the tropics. The profound modifications in the system produced by heat are, I believe, in some degree hereditarily transmissible. For the children of those who have suffered much from so-called malarious disease are more liable to similar maladies, and children may be born with large spleens, or may suffer from ague before they are born. It is now, therefore, generally admitted that Europeans cannot flourish in the lowlands of tropical countries.

It has been, however, thought that Europeans might colonise the elevated regions of tropical countries; and we have recently heard much of smiling European villages rising on the highlands of tropical Africa. I at once admit that elevation renders bearable, and comparatively agreeable, regions otherwise uninhabitable by Europeans. This is,

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* The amount of air passing through the lungs has been estimated at 400 cubic feet in a state of rest; 600 feet in exercise; 1,000 feet in severe exertion. During exertion large quantities of carbonic acid are exhaled from the lungs, from the combustion of carbo-hydrates.

† Dr. Lauder Brunton has pointed out this. *Vide* "Disorders of Digestion."

‡ Dr. Forbes Watson showed this years since.

§ If from any cause the free and normal aëration of the blood is interfered with, the quantity of hæmoglobin is also decreased.

|| To the extent, as calculated by De Chaumount, of 25 per cent.

however, entirely due to the fact that altitude diminishes heat, the rarity of the air admitting of less absorption, and distance from the plains preventing so much terrestrial radiation. There is also often greater movement of air. The actual temperature of elevated regions, however, differs much from what might be inferred from latitude;* aspect, proximity to the sea, rainfall, physical configuration, and hemisphere† being controlling conditions. Hence it occurs that most high ranges have peculiarities of climate, not only as regards temperature, but as regards dryness, dampness, wind-force, and all conditions affecting health. But short of the snow-line‡, the climate is more or less a tropical climate. There is the vertical or almost vertical sun above, giving however, more heat at some distance from the equator.§ There are the characteristic hot, wet, and cold seasons, the two latter being in some localities even more pronounced. But the nearer the equator, the less the cold season. And although there the temperature is more equable, this does not compensate for the absence of the invigorating influence of a prolonged cold season.

In short, the climate of the highlands of a tropical region is the climate of the lowlands, tempered by that diminution of heat obtained by elevation, increased rainfall, and forests. To obtain a mean temperature, as that of London, for instance (51° F.), a person must ascend 10,000 feet in any country where the sea-board has a temperature of 80° F.||

Although such an elevation and temperature are certainly not essential, the evils of expanded air are not escaped at a much lower elevation; for, as ascent is made, the density of the air is diminished by lessened weight of superincumbent atmosphere. It is estimated that on ascending a hill 1,000 feet high, the pressure is reduced by half a pound

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* Algiers, for instance, is more unhealthy for Europeans than the Cape, but both places are about lat. 35°. New South Wales is more healthy than the East or West Indies, which are at the same latitude.

† At lat. 20° there is a difference of 3·4° F. between the temperature in the northern and southern hemisphere, the southern being the warmer. At lat. 30° there is a difference of 2·9° F.

‡ The snow-line varies much. On the Himmalayehs, for instance, owing principally to the greater fall of rain, it is 1,000 feet higher on the south than on the north side of the range.

§ At the end of the first month after the equinox, the sun has advanced 12° of lat. towards the tropics; in the second month it traverses only 8°, and is 20° from the equator. There remains only 3·5° to be traversed in the third month. The sun recedes in the same way. Hence, at all places between 20° and 23° of lat., the solar rays during two months fall at noon almost perpendicularly, or at an angle at most of 3·5°. A place situated exactly under the equator has only during six days the sun as near its zenith as other places have it during two whole months. The degree of temperature is also increased by the length of the days, which near the equator are 13½ hours, but at the equator always 12 hours. This was known to the ancients, the Greek philosopher Posidonius proposing to regard certain countries as forming a zone intermediate between the equatorial and temperate.

|| Other conditions being equal, a place having an altitude of 6,000 feet would register a temperature 20° lower than that of a place in the same latitude at the sea level; one having an altitude of 15,000 feet would have a temperature 50° lower.

on every square inch, or 128 lbs. on the average chest alone. At 2,000 feet, by 256 lbs. on the chest; at 4,000 feet, by over 500 lbs. The chest, especially that of young people, often enlarges, during the first period of residence on elevated regions, and probably the lessened pressure contributes to this change. A development which may be regarded as in some degree, but not as sufficiently, compensating for the difference in the amount of oxygen inhaled, which at 6,000 feet elevation is stated by Parkes to be 23½ grains per hour. Ascents in balloons, or of very high mountains, have caused giddiness, nausea, difficulty of breathing, and hæmorrhages.* But there are many persons who experience unpleasant effects at a comparatively slight elevation, especially insomnia.†

Diarrhœa alba is also a well known complaint affecting persons living on tropical elevations. Neither are such elevations free from fever. Several hill stations in India are "feverish." Stanley (Vol. 2, page 32, of "*Darkest Africa*") remarks that, from 0 to 5,000 feet above the sea, there is no immunity from fever and ague; and he mentions that Jephson, Parke, and himself were attacked by fever and prostrated on the plateau of Kavalli, 4,500 feet above the sea. It is manifest from experience that in the lower stratum of atmosphere, extending to upwards of 4,000 feet in tropical countries, terrestrio-miasmatic affections are prevalent to an intense degree; while, in the second stratum, extending to 10,000 feet, fluctuations of physiological phenomena are the characteristics, according to the seasons—in winter, inflammatory, and tending to thoracic complications; in summer, congestive, and affecting abdominal organs. For a climate favourable to the integrity of one set of organs is often unfavourable to the integrity of another. If an ascent is made sufficient to remove the individual from all the effects of heat, a climate is attained where, in addition to the effects of rarified air, the diseases of cold climates become more active, while the maladies of tropical climates are not altogether escaped.‡

Much discussion has taken place in India with regard to the proper elevation at which to establish a hill station, the difficulty being that, while avoiding bad types of malarious fevers by elevation, another class of diseases was encountered as height was attained. I have elsewhere recorded my views that any specified height, such as six, seven, or eight thousand feet, is not a *sine quâ non* for an Indian hill station. It is sufficient if the elevation removes the European from the stratum of hot air, and, therefore, above the influence of the fiery winds of the north and the damp heat of the south. This, however, while satisfactory

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* The lessened pressure on the body causes the minute blood vessels of the more delicate parts to become dilated, and even to rupture.

† Such effects are a sense of constriction of the chest, and sometimes of the abdomen. The person feels unable to take a deep breath. Slight exertion causes fatigue, and insomnia is common. Any pre-existing heart affection becomes dangerous, and there is liability to congestion of internal organs.

‡ For instance, cholera has prevailed at Murree, elevation 7,300 feet; at Dhurmsala, elevation 6,000 feet; at Kusowlee, nearly 6,000 feet; and at Mount Aboo, 4,000 feet.

for the temporary sojourn of soldiers, is not sufficient for colonisation. The still powerful sun, the rarified air, the prevalence of marked seasonal influences, the heavy rainy season with its attendant clouds and damp, and, near the equator, little or no comparatively cold weather, must eventually tend to anæmia and racial degeneration.

Again, if land is to be occupied, it must be cleared and cultivated. Clearance of forests tends to lessen rainfall, to allow the ground to absorb more heat, and to radiate it more rapidly, thus producing great vicissitudes of temperature, and, as we know from Indian experience, renders the climate hotter at one period of the day and of the season, and colder at another, and, therefore, more unhealthy.

There is also another aspect of the question. What we know of the effects of the temperate climate of elevations is principally derived from our experience of mountains. And it may be asserted that mountains of less than five to six thousand feet elevation do not, in the tropics, afford that temperature which is favourable to the European. If a mountain does not present an abrupt elevation it will have a higher thermometric scale. An extended table-land, which is required for European colonisation, would be much hotter than a mountain slope of similar elevation, as there would be more radiation of heat from surrounding level ground. I am not aware of a table-land of any extent in a tropical country having the necessary elevation.*

Of the numerous pensioners and others who have settled in India none have been colonists. There is not a descendant of the fourth generation of pure European blood. Many years ago I was asked by the late Sir Henry Lawrence as to the practicability of establishing European colonies on the hill ranges of India. I then stated that it was impracticable, and I have since had no reason to alter my views, but rather the reverse.†

I was afterwards connected for some years, as medical officer and secretary, with one of the hill asylums for European children, founded by the late Sir Henry Lawrence. I found that the physique of the children, especially of females, was, in after-life, much inferior to that of children brought up in England. Tropical climates, whether of the

* The table-land of the Deccan, in India, has the mildest climate of the plains of India, its elevation, in some parts, being 2,000 feet; but Europeans cannot colonise it.

† Mr. Isaac Taylor, in his "Origin of the Aryans," points out that the actual descendants of the Aryans, who were a white race, are rare, and are represented by certain princely and priestly families who do no manual labour. Mr. Justin Winsor, in his large "History of America," mentions two temperate districts as being those in which alone "the inhabitants have maintained the original energy of the race that founded the colonies." Dr. Ahearne, President of the North Queensland Medical Society, states that European children in the north or hot part of Australia become pallid, thin, and worn, and exhibit a racial type very different from that of those in the temperate parts. The Dutch have failed to naturalise themselves in Java and Sumatra, and have left no descendants in Ceylon. In the West Indies and New Orleans the French exist, but do not increase. In Algeria emigrants from the north of France fail to become acclimatised, while those from the south succeed better. Peru is still the country of the Incas. No European race has established itself in Mexico, or in Egypt.

plains or of the hills, produce—especially among Europeans—great infant mortality (something of which, however, must be attributed to ignorance and neglect), anæmia, and sterility. Anæmia must indeed be regarded as physiological in a hot climate, and anæmia renders the subject more liable to any other ailment.

Dr. Hans Meyer, in his recently published work, "The First Ascent of Kilimanjaro," says: "Look where you will through the central "regions of the dark continent . . . . . all alike wear the "Hippocratic face." The temperate climate of altitude may delay the conditions which produce this aspect, but it will not protect from them ultimately. The lower animals and vegetables of temperate climates degenerate, and often die in the tropics, and it is the same with human beings.

An infusion of native blood seems essential to the continuance of the species, and the type of the race becomes the type of that race which conforms best to environment. It is the same with black races located in temperate climates. It is authoritatively stated that of negros in the Northern States of America, one out of every four is born deaf, dumb, blind, idiotic, or insane; while the majority are sickly and especially liable to pulmonary affections. I do not mean to say that an European may not live long and enjoy good health on a tropical elevated site; but I say that he must be free from labour under a tropical mountain sun, and especially in tropical mountain valleys, which are generally essentially malarious. His work must be that of superintendence, and not actually manual. But even with these conditions, I say that all experience and reasoning are against an European founding a family, and against his descendants living and retaining their mental and physical characteristics as they do in a temperate climate, whether on tropical plains or on tropical hills. The temperate climate of elevation will not supply the place of the temperate climate of latitude.

Lastly, I venture to remark that, when persons proceed to a tropical climate, often sufficient care is not taken to ascertain if they are fitted for residence in such a climate. Under precisely similar circumstances of climate, men, by reason of their different temperaments and constitutions, suffer in varying degrees from heat. There are certain temperaments and constitutions which a tropical climate suits, and there are the reverse. Diseases already experienced, and hereditary tendency to disease, should also be taken into consideration. Then, there are certain peculiar idiosyncracies which unfit for tropical life; and, as before referred to, there are some constitutions altogether unfitted for elevated sites.

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TRANSACTIONS

OF THE

Seventh International Congress of Hygiene and Demography.

LONDON, AUGUST 10TH–17TH, 1891.

Patron:—HER MAJESTY THE QUEEN.

President:—H.R.H. THE PRINCE OF WALES, K.G.

VOLUME XII.

MUNICIPAL HYGIENE AND DEMOGRAPHY.

EDITED BY C. E. SHELLY, M.A., M.D.

LONDON:
PRINTED BY EYRE AND SPOTTISWOODE,
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1892.

To the Corporation of Dundee is due the credit of originating a suggestion made during the earlier part of the year, in response to which a number of Municipal bodies supplied the Honorary Secretary General of the Congress with brief reports relating to their vital statistics and corporate history, and embodying the results of local sanitation. These communications*—which were obviously unsuited, and were not intended, to form a subject of discussion by the Congress—are collected in the present volume, and, in order to facilitate reference, have been arranged in alphabetical order under the names of the cities and towns to which they severally refer. They thus present, in a compact and accessible form, a considerable mass of information, which can scarcely fail to prove valuable as well as interesting. For—dealing, as they do, more or less fully with all the great questions of modern sanitation—they indicate some of the many ways in which these problems have arisen, the causes which have operated to make them urgent, and the methods by which they are being successfully solved by communities varying within wide limits of population and of very different rates of growth, existing under a diversity of social conditions, and occupying areas that differ greatly in extent, in configuration, and in climate.

G. V. Poore,
Honorary Secretary General.

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* Including those furnished by the Municipalities of Ahmedabad, Bombay, Calcutta, and Rangoon, which also appear in Vol. XI., *Indian Hygiene and Demography.*

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MUNICIPAL HYGIENE AND DEMOGRAPHY.

The City of Aberdeen.

Delegates to the Congress.

Lord Provost DAVID STEWART.
Councillor GEORGE MACONNACHIE.
Professor MATTHEW HAY, M.D.

The city of Aberdeen is, with the exception of a small part south of the River Dee, wholly situated on a gently rising ground between the Rivers Dee and Don, and extends downwards along the Dee to the shore of the North Sea. Its elevation above sea-level varies from a few feet to 300 feet, the mass of the city being under 100 feet. Its position is, therefore, on the whole, favourable to good drainage.

The population, as estimated to the middle of the present year, is, within the recently extended boundary of the city, 125,560; and the area amounts to 6,602 acres, or nearly 10 square miles. In spite of several natural disadvantages, such as distance from coal and iron markets, the population has increased with remarkable rapidity in recent decades, the percentage of increase at the recent census being over 16, and at each of the previous censuses of 1871 and 1881 over 19. Aberdeen is, therefore, one of the most rapidly growing of the larger towns in Scotland. Its area is now the largest of the Scottish towns, but much of the portion recently added is unbuilt upon.

For the ten years ending 1890 the following are the averages of the meteorological observations during the four quarters of the year:—

1881-90.	Mean Barometric Pressure (at Sea-level and 32° F.).	Temperature.		Mean Humidity. Sat. = 100.	Rain.		Average Number of Hours of Bright Sunshine daily.	Rain.	
		Mean.	Daily Range.		No. of Days it fell.	Amount.		Prevailing Directions.	Mean Pressure on sq. foot.
	Ins.	°F.	°F.			Ins.			lbs.
1st Quarter -	29·747	38·7	10·4	82	56	7·2	3·0	S.W., N., & N.W.	1·2
2nd Quarter -	29·900	48·6	13·4	76	48	5·9	6·1	S., N., & S.E.	0·8
3rd Quarter -	29·842	55·1	13·0	79	55	8·2	5·2	S.W., N.W., & N.	0·7
4th Quarter -	29·792	41·5	10·1	82	59	9·1	2·2	S.W., W., & N.W.	1·1
Whole Year -	29·822	45·9	11·7	80	218	30·4	4·1	S.W., N., & N.W.	0·9

The climate is somewhat colder but less wet than the average of Great Britain, and is distinctly bracing, even to occasional harshness, especially in early spring.

Housing.—As in other towns of ancient origin, the streets were all at one time narrow and ill-conditioned. But within the present century great improvements have been carried out which have completely altered the character of the town. In the first place, at the beginning of the century, two streets of splendid proportions were projected at right angles to each other from the old market-place in the centre of the town, and along these are now reared the chief buildings of the city, and they form the great avenues of the city's traffic. By a scheme, only just completed, and costing 125,000*l.*, further improvements of a similar kind have been effected, which add greatly to the beauty of the town. The total number of streets and roads in the city now amount to 530, and

their total length to 110 miles. The houses are mostly three to four, and occasionally five storeys in height, and are, almost without exception, built of impervious granite. The houses in the centre of the older parts of the town are still in many cases deficient when judged by modern standards; but comparatively few houses remain which are unalterably bad. The working classes live almost wholly in so-called tenement-houses, four, six, or eight families entering their houses from a common staircase. This mode of housing is still being adhered to in the most recently built houses. The wealthier classes are largely housed in terraces or detached villas, and many of the better off artizans and middle classes (relatively

speaking) are showing a preference for houses with a separate entrance, and with a modicum of garden. Neither the local authority nor any other public body has undertaken the erection of houses for the working classes. By a local Police Act of 1862 considerable powers were granted to the Corporation for the regulation of new buildings, and these powers are now being very fully exercised. It is questionable if there exist in any other city more advanced regulations for the plans and for the drainage and ventilation of new houses; and they are rigorously enforced. Very active attention has also been given in recent years by the sanitary officials to the drainage and ventilation of old houses, with the result that annually many hundreds of such houses have their drainage and general sanitary arrangements remodelled and brought into conformity with the most modern requirements. Under the Aberdeen Corporation Act of 1881 the Town Council acquired power, without opportunity of appeal by owner, to close any house which is certified by their medical officer of health or sanitary inspector, or by any two medical practitioners, to be unfit for human habitation. This somewhat arbitrary power has been judiciously utilised by the Council for the closure of several hundreds of the worst houses without serious protest on the part of owners.

Only one scheme has as yet been carried out under the Housing of the Working Classes Acts, viz., that for the demolition in 1884, at a cost of nearly 16,000*l.*, of an area of old, low-lying, and highly insanitary property, in which repeated outbreaks of typhus fever had occurred. Similar schemes for other areas in the city are likely to be under the consideration of the Council very soon.

Water-Supply.—Previous to 1866 the city obtained its water-supply from the River Dee, at a point about a mile above the city. The water was pumped by an engine to a large water-tank in a building in the upper part of the city. In 1866 this supply was discontinued, and a fresh and much more abundant supply was introduced from a point in the Dee more than 20 miles from Aberdeen, and filter beds and storage reservoirs were at the same time constructed. The water thus obtained is sufficient for the supply of the greater part of the town by natural gravitation; but the higher parts are supplied from separate reservoirs to which the water is raised by steam-pumping. The Corporation obtained parliamentary power to take 8,000,000 gallons daily from the Dee. The consumption for 1890 was 6,500,000 gallons daily, or about 60 gallons per head of population. The waterworks have cost up to the present time 255,000*l.* Except for slight sewage pollution from the two or three villages on its banks—and steps are being taken to prevent this—the Dee affords a water of great natural purity, containing, on an average, about 3½ grains of total solids, ½ grain of chlorine, ·01 part (per mill.) of free ammonia, and ·04 part (per mill.) of albuminoid ammonia, and scarcely more than 1° of hardness. It is, therefore, a water which is eminently suitable for both domestic and manufacturing purposes. It is almost unnecessary to add that the supply is constant, and that house-cisterns for water for potable purposes are not permitted in new houses, and have been largely extirpated from older houses.

Sewerage.—Owing to the abundance of the water-supply, the wet system for the disposal of sewage is employed, and waterclosets are, almost without exception, in universal use. In 1864 a thorough system of drainage works was commenced at a total cost up to the present time of about 120,000*l.* The total number of main sewers is now 450, and they measure 68 miles in length. With the exception of a small portion which is used for irrigation purposes, the whole of the sewage is discharged unpurified into the Dee, the greater part at the extreme mouth of the Dee, but within the breakwaters, and the remainder at a point opposite the middle of the town. It is proposed to remove the latter outfall further down the river. The outfall of the sewage within the mouth of a tidal river is undesirable, and proposals have recently been made to have it transferred to some point on the coast line, but, as yet, no plan has been adopted. The small part of the sewage used for irrigation is conveyed to a farm of about 50 acres, close to the sea, and the owner pays a rent of 100*l.* annually for the use of the sewage. The farm, though not far removed from dwelling-houses, has not been found to be injurious to health.

Disposal of Refuse.—The refuse of the City is collected by means of carts and is removed to a railway depôt, about half a mile outside the town, from which it is sold and distributed to farmers for manurial purposes at a price varying from 1*s.* 3*d.* to 2*s.* per ton. No destructor is in use in Aberdeen for the treatment of refuse. The cleansing or scavenging staff consists of an Inspector and 124 men, and requires the services of 50 horses.

Common Lodging-Houses; public Wash-Houses; public Baths; Slaughter-Houses.—None of these have been as yet erected by the municipality, although proposals to do so have frequently been discussed. The lodging-houses are privately owned, and are almost wholly located in the older and more overcrowded parts of the city, in very old buildings originally erected for other purposes. The minimum amount of cubic space now allowed to each adult lodger is 400 cubic feet; before the year 1891 it was 300 cubic feet. Although there are no public baths owned by the Corporation, a private company erected a handsome and well-equipped building for baths, in the east end of the city, a few years ago, and their baths are extensively patronised by all classes. The sea itself, being close at hand, is largely used for bathing in summer. The city is greatly in need of a general and municipal slaughter-house; but although plans of such a slaughter-house were at one time before the Council, the slaughter-houses are still privately owned, the work being, however, concentrated mainly in two large buildings.

Hospitals, &c.—The city is well provided with hospitals and other means for treating the sick. The principal hospital is the Royal Infirmary (founded 1739), with accommodation for 200 patients (and, after reconstruction, for 250). It is at present undergoing complete reconstruction on the most advanced principles, at a cost of 40,000*l.* to 50,000*l.* It is to be lighted by electricity, and will probably be in part ventilated by Key's mechanical method. There is also a recently erected hospital for

sick children, accommodating about 80 patients; and a commodious and elegant hospital for incurables. The City (Fever) Hospital accommodates fully 100 patients, and was erected and is maintained by the municipality. It is situated on the outskirt of the east end of the town, and consists of an administration block, five one-storey pavilions of wards, and a reception house—all distinctly separated. Excepting one pavilion, which is of wood, it is built of concrete, and cost over 16,000*l.* It is utilised for the treatment of all the ordinary infectious diseases or fevers, except typhoid fever, cases of which are still treated in the general hospitals. Scarlet fever cases constitute the bulk of those treated in the Fever Hospital, but recently large numbers of measles cases have also been admitted. During the five years ending 1890, the average number of patients (exclusive of quarantines) admitted in each year to the hospital was 403·6, out of an average city population of 105,000. The average number of scarlet fever patients was 259; of measles, 103; of typhus, 11; of small-pox, 9; and of diphtheria, 5. In 1890, of all the zymotic cases known to have occurred in the city, 70 per cent. were removed to the hospital; in 1889, 51 per cent.; in 1888, 65 per cent.; in 1887, 46 per cent.; and in 1886, 50 per cent. The percentage of deaths among the cases treated in the hospital was in each year considerably less than in cases treated outside. The Fever Hospital is therefore performing a double service to the public health, firstly, in restricting the spread of infectious disease, and, secondly, in lessening the mortality among infected cases. Besides the hospitals enumerated, there is also a large and well-managed dispensary for the out-door relief of the indigent sick.

Public Disinfector.—A disinfecting station and wash-house have been erected in the grounds of the Fever Hospital, and are used for the treatment of all infected clothing and bedding. The form of disinfector employed is a Washington-Lyon's hot steam apparatus. It has been found to work well.

Notification of Infectious Diseases.—Notification by the medical attendant was made compulsory by a local Act in 1881. This year the Infectious Disease (Notification) Act, 1889, has been adopted in order to obtain the advantages of dual notification; and measles and whooping cough have been added to the list of diseases named in the Act. These diseases were in the local Act. Notification is carried out very faithfully on the whole, and has been of great service to the Sanitary Department.

Educational Institutions.—Aberdeen, until about thirty years ago, was the seat of two Universities, one founded in 1494, and the other in 1593. These are now incorporated into one University, with a staff of 22 professors, besides lecturers, and an annual attendance of between 900 and 1,000 students, endowed with bursaries to the annual value of 7,400*l.* With the exception of about 60 to 70 in attendance in the Faculties of Law and Divinity, the students are nearly equally divided between the Faculties of Arts and Medicine. At present a large scheme of extension of the University buildings, to accommodate the increasing number of students, and to meet the growing demands of science teaching, is under consideration.

Aberdeen also possesses an excellent Grammar or High School, founded in the thirteenth century, which has within recent years been re-housed in new and stately buildings. The City also contains an institution known as Robert Gordon's College, which, though originally intended by the founder for the education and upbringing of the sons of the poor, has, without detriment to the purpose of the founder, become an important secondary school, and especially has provided a large amount of technical education for the youth of all classes, having indeed been in this respect one of the pioneers of technical education in Great Britain. Much attention has in recent years been given to the proper warming and ventilation of the public schools of the city, with the result that many of them are now ventilated by mechanical (propulsion) means; and Aberdeen is probably more advanced in this respect than any other town in the kingdom.

Public Parks.—The city would be well supplied with public parks, provided some of them were more centrally situated. Between the city and the sea is a large area (300 acres) of common ground, the Links, which is largely used by the working classes for recreation purposes. Near the centre of the town are the Union Terrace Gardens (3¼ acres), and at the west and south margins of the town are the Victoria Park (14½ acres, and costing 5,200*l.*), and the Duthie Park (44½ acres, valued at 40,000*l.*), the latter of which was presented to the city in 1881 by Miss Duthie, of Ruthrieston, and is one of the most beautiful municipal parks in the kingdom.

Public Gymnasium.—An excellent gymnasium has recently been established through the energy and liberality of some public-spirited citizens, and is doing good work both within its own walls and by encouraging the teaching of gymnastics in many of the schools.

Public Libraries and Art Gallery.—The Public Libraries Act was adopted by the city in 1884, and a handsome new edifice for the accommodation of the library, costing about 9,000*l.*, is nearly completed. The library at present consists of about 32,000 volumes. There is also a large and very valuable library connected with the University, and containing upwards of 100,000 volumes. An Art Gallery was erected a few years ago at a cost of 6,300*l.*, and it already contains some excellent examples of the painter's art, which will be greatly added to when the Macdonald collection of paintings—of unique character in some respects—comes to be transferred to the Gallery. An excellent Art School was at the same time erected in contiguity to the Gallery, the school being the gift of Mr. John Gray.

Industries, &c.—The city has no chief and outstanding industry. Exclusive of those connected with the extensive agricultural operations of the surrounding district the most characteristic industry is, perhaps, granite-polishing. But there are also extensive works for paper-making; flax, cotton, wool and jute spinning and weaving; comb-making, soap-making, and shipbuilding. With the introduction of trawling, fishing has sprung into increasing importance, and is now a very considerable source of employment and wealth. The total value of the fish brought into the port during the year 1890 was 243,630*l.*

Aberdeen has an excellent harbour, on which very large sums of money have been spent, and it enjoys a considerable position as a shipping port. The city has also a well-developed tramway system, there being 9 miles of lines, which were constructed at a cost of 39,200*l.*

Vital Statistics.—The average annual birth-rate for the five years ending 1890 was 32·8 per 1,000 of the population. In the five years ending 1870 it was 36·3, since which time it has gradually fallen. Aberdeen enjoys, along with Dundee, among Scottish towns, the unenviable position of having a high proportion of illegitimate births. The average proportion in 1886–90 was 10·4 per cent. of the total births. In 1866–70 it was 12·9 per cent., and it fell to its present proportion about five years later.

The average annual marriage-rate for 1886–90 was 7·7 per 1,000 of population. In 1866–70 it was 8·2. It fell soon afterwards to nearly its present rate.

The average annual death-rate per 1,000 for each of the successive quinquennial periods from 1855 to 1890 has been 23·8, 24·8, 23·54, 22·48, 20·96, 19·74, and 19·84. A very heavy epidemic of measles in 1887, and a visitation of influenza in 1890 have helped to considerably raise the average of the last quinquennium. The lowest rate in any individual year was in 1885, when it was 17·9. The average annual death-rate among persons under 5 years of age during the past 10 years was 51·3 per 1,000; among persons of 5 to 60 years, 9·1; and among persons over 60 years, 68·6. The mortality from tubercular and from zymotic diseases has very considerably and steadily declined during the last 20 years.

Sanitary Administration.—The sewerage and water-supply are entirely under the management of the burgh engineer and surveyor and his staff, subject to the direction of the Town Council. The sanitary arrangements of all new buildings, at the time of their erection, are subject to his control and inspection. The inspection of the sanitary arrangements of the city otherwise is in the hands of the sanitary officials. Until less than ten years ago the sanitary staff consisted only of the medical officer of health and the sanitary inspector. At present it comprises, in addition to these officials, six assistant inspectors, one of whom is specially charged with the examination of food, a second with the inspection of dairies, and a third with the visitation of cases of infectious disease. Other assistants are also employed for the removal of infected clothing, etc.

The Borough of Andover.

Delegates to the Congress:

Councillor W. Bracher (Mayor).
Alderman H. P. Moore.

Andover is one of the most ancient boroughs in England. Nearly 900 years ago the then king of Norway, "Aulif," was confirmed by King Ethelred in the Saxon church at Andover. The church was given by William the Conqueror to the abbey at Saumur, in Anjou, and was attached to it until dissolved by Henry V., who gave it to Winchester College. The borough possesses several charters in a beautiful state of preservation, one of which was granted by Henry 1st, another by King John.

The manufacture of shalloons was formerly extensively carried on here. The town is now a purely agricultural one.

The country around abounds with ancient entrenchments, of which the most noticeable are Danebury and Quarley, and also Bury Hill, a very fine entrenchment.

There is a beautiful semi-circular walk called "The Ladies Walk," which commands the town, forming a turf promenade 20 feet wide, and more than a mile-and-a-half in length, from which the two adjoining counties of Berks and Wilts are distinctly visible.

The town possesses a recreation ground of upwards of seven acres, which was acquired in the Jubilee year.

The town has recently acquired the control of the waterworks formerly belonging to a private company, the water of which has proved on analysis to be of the purest description.

Notwithstanding the agricultural depression, the borough has slightly increased during the last decade, during which period a great many new buildings have been erected. Owing to its capital railway accommodation and the very salubrious air, it is reasonable to believe that it will continue to increase.

The death-rate is low, not exceeding an average of 18 per 1,000.

The population of Andover Parish, including the hamlets, is 5,852.

The City of Belfast.

Delegates to the Congress.

C. C. Connor, Mayor.
Alderman Graham, M.D.
Henry Whitaker, M.D., Medical Superintendent Officer of Health.
Conway Scott, C.E., Executive Sanitary Officer.

The city of Belfast, the capital of Ulster, is situated chiefly in the county of Antrim; but includes in its boundaries the large and increasing district of Ballymacarrett in the county of Down, from which it is separated by the River Lagan, which here empties itself into the Belfast Lough about ten miles from the Irish Channel. Its present municipal boundary comprises 4,322 acres in county Antrim and 1,668 in county Down. There is also an additional area of 814 acres of tideway included in the city boundary; while for Parliamentary purposes a further area of 3,766 acres of suburbs in both counties has been added. In the year 1841 Belfast became a corporate town; and very shortly afterwards the town council took steps to carry out great and much needed improvements, especially in the centre of the city; they swept away many of the narrow and unhealthy lanes and alleys—which, built in earlier times, abutted upon the main thoroughfares—made new streets and widened old ones, established new markets; and in conjunction with the Harbour Commissioners, who at the same time carried out great improvements in filling up old and insanitary docks and making new lines of quay frontage to the river, commenced an era of improvement which though not yet completed, has made the leading streets and thoroughfares a credit to the community and second to few in the Empire.

The population of Belfast in 1782 was 13,105; in 1831, 48,224; in 1861, 120,777; in 1881, 208,122; and in 1891, 255,896; being now at the rate of 39·2 persons to each acre. Its rateable valuation was in 1871, 460,802*l.*; in 1881, 603,732*l.*; and in 1891, 711,406*l.* Few cities (if any) in the United Kingdom can point to the same steady and unvarying rate of progress, as testified by increase in population and in rateable value; while at the same time its material prosperity and success is amply shown by the many and varied industries which within the last half century have risen and thriven in its midst.

Belfast Lough is a wide expanse of comparatively shallow water, with picturesque hills on either side, by which vessels within it are protected from gales blowing from almost any direction. Hence it is largely used by shipping as a harbour of refuge, and the new channels made in it (upwards of four miles in length) by the Harbour Commissioners, enable vessels of large draught to come up to the quays,—where the river unfortunately receives the greater part of the sewerage of the city; this, however, is being remedied by a system of intercepting sewers which are now being constructed by the Corporation. The amount expended by the Harbour Commissioners on harbour improvement

and quayage since 1846 amounts to 1,400,000*l.*, and their revenue for the year 1890 was 121,500*l.*

The streets, lanes, and alleys in the old parts of the city were close and narrow, with high houses and little sanitary accommodation; they, however, are few in number and are rapidly disappearing. The lanes and alleys are being closed, the houses pulled down, new and spacious thoroughfares opened, old and narrow streets widened, open spaces secured, and the means of sanitation amply provided for. At the present time the Corporation have applied for powers under "The Housing of the Working Classes Act" to clear away a large district of unhealthy houses with a view to its proper re-arrangement. The artizans in general are well housed; miles of two-storied houses, each with some four rooms and a small backyard, are found in every district of the city; so that each family can have the great privilege of having a separate house, for the cleanliness of which they alone are accountable and with the privacy of which their neighbours cannot interfere. In the event of an epidemic of infectious disease occurring, the advantage of the small and self-contained separate houses as compared with the tenement house is very obvious.

The parks belonging to the city are well kept and pleasantly situated. The principal one is Ormeau Park, formerly the demesne of the Marquis of Donegall, containing about 175 acres of well wooded and beautifully planted grounds rising almost abruptly from the bed of the River Lagan. It is to be regretted that the greater part of the river adjoining is formed of slob land which, lying exposed except at high tide, gives forth a most unpleasant smell, especially in warm weather. The Corporation hope by their present sewerage scheme, which will remove the sewage from the river, greatly to mitigate if not altogether to do away with this undoubted nuisance. Another park containing 44 acres, adjoining the City Cemetery, is pleasantly situated at the foot of the hills overlooking the valley of the Lagan, for the Falls Road district; and another smaller one, the "Alexandra," for the shore and Antrim Road districts. Woodvale Park, containing 24 acres, in the neighbourhood of the important and densely populated district of Shankhill; and the Dunville Park, recently presented by Mr. Robert G. Dunville, D.L., to the city, and more immediately convenient to the dwellings of the working people, complete the list of the parks now open to the public; whilst the Victoria Park near Ballymacarrett, adjoining the seaside, and containing about 60 acres, is about to be made available for the inhabitants of that neighbourhood.

The water-supply to the city is under the control of a body of commissioners, 15 in number, chosen by the ratepayers, and elected in a somewhat similar manner to the members of the town council. These gentlemen have shown a wise foresight and discernment in the management of this important trust. The rapid increase of the city, and the dema: . for sufficient water, not only for household and sanitary but also for business and manufacturing purposes, called for considerable efforts, and necessitated a large outlay. Within the last 50 years the water commissioners have had, on three occasions, to erect new and more

extensive works for the supply and storage of water. First in 1840, about a mile from the centre of the city on the Antrim Road, where basins were placed capable of holding about 180 million gallons; secondly about the year 1865, at Woodburn and Lough Mourne district, reservoirs which, with subsequent extensions, now possess a storage capacity of upwards of 1,500 million gallons; and latterly, at Stonyford, about 8 miles from Belfast, where a reservoir has been erected, the area of which is about 160 acres, and its capacity about 700 million gallons. The quality of the water is very fair; it is principally obtained from upland pasture, and has a moderate degree of hardness. Filtration beds on an extensive scale, and on the most improved principle are at present being erected in connexion with the works, so that both for quantity and quality the water furnished to the city will bear favourable comparison with that supplied to other large centres of industry. The expense has been comparatively great; the rapid growth of the city and great demand for water could scarcely have been foreseen, and hence the extra expense necessarily incurred by the execution of new works from time to time to meet the increasing demand. The total amount expended on the waterworks (capital account) since 1840, amounts to 655,511*l.* The daily quantity of water at present delivered into the city is 9¼ million gallons, equal to a supply of 34 gallons per head per day of the population supplied.

In the year 1879, the first public baths were established in Belfast, at a cost of 6,500*l.*, and were so much appreciated that the Corporation, when making a new street in the centre of the city, Ormeau Avenue, set apart a portion of ground therein upon which to erect new baths; this they did in 1888, at a cost of 10,500*l.*; these have proved very successful, and are often inconveniently overcrowded. To remedy this, and in compliance with the wishes of those living on the county Down side of the river, the Public Health Committee are at present erecting new baths in Ballymacarrett.

When the Corporation took over the charge of the streets of Belfast, they were merely macadamized, and in few, if any of the streets were the footpaths flagged. It was not until the year 1874 that powers were obtained from Parliament by which the paving of the city in a permanent and substantial manner could be attempted. Since that date 45,000*l.* has been expended on square setting some of the principal streets; and a loan of 50,000*l.* has just been obtained for a similar purpose. The footpaths were in general very rudimentary, and only flagged in small patches or in the leading squares. Since 1884, in which year an Act of Parliament was obtained authorizing the expenditure of 50,000*l.* in flagging, great progress has been and still continues to be made, 48,000*l.* having been already expended for that purpose. Upwards of one million and a half has been expended since 1846, for all purposes; this sum, however, includes cost of forming markets, and nearly 500,000*l.* expended for the purchase of gas works.

For many years the importance of a proper system of sewerage has pressed itself upon the attention of the Corporation, and so long ago as the year 1866, the late Mr. Montgomery, C.E., borough surveyor,

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presented an exhaustive report entering fully into the matter, and showing the difficulties to be encountered in carrying out a good and sufficient plan in the city, the greater part of which was built on marshy and mud land mainly reclaimed from the bed of the river, and so little above high water level that an outfall could hardly be given to the sewers. Sir Joseph Bazalgette was consulted and approved generally of the scheme, although he suggested some alterations therein; as however, a very large sum of money would have had to be raised and an Act of Parliament obtained for this purpose, the matter was allowed to remain in abeyance until 1885. In the meantime, however, district sewers were constructed in different parts of the city, all so arranged as to form part of a grand sewerage scheme to be thereafter carried into effect.

The Belfast Main Drainage Act of 1887 empowers the Corporation to carry out a scheme of intercepting sewerage for the entire city somewhat on the lines of the Main Drainage of London. The works comprised by this scheme are the construction of trunk or intercepting high-level and low-level sewers together with an outfall sewer and covered storage reservoir, 5,000,000 gals. in capacity, erected in a new enclosure reclaimed from the tide by embankments; also a covered timber outlet sewer one mile in length along the tidal lands of Belfast Lough, through which the sewage flowing from the reservoir will be discharged into the deep water of Whitehouse Roads. The scheme also embraces a pumping-station to lift the low-level sewage into the outfall sewer, and an auxiliary pumping-station near the storage reservoir to raise sewage into the latter at certain times when the flow cannot be properly obtained by gravitation. The construction of the timber outlet sewer has proved to be a difficult work, the sewer being below ordinary low-water level. However it is now practically completed, and the embankments reclaiming some 25 acres for the purpose of providing a site for the storage reservoir, auxiliary pumping-station and accessories, are now just being finished. The outfall sewer and first sections of the high-level and low-level trunk sewers have already been constructed, having a temporary outlet into the tidal Milewater River pending the completion of the outlet works. The buildings of the pumping-station are rapidly nearing completion; and a contract has been recently let comprising the construction of the storage reservoir and buildings of the auxiliary pumping-station.

The works yet requiring to be undertaken are the extensions of the high-level and low-level trunk sewers, and the continuation of the latter work under the tidal River Lagan in order to intercept the sewage of that portion of the city on the eastern side of the river.

Before the full advantage of the scheme can be obtained, many subsidiary sewers and works will have to be carried out in order that the sewage now flowing into and polluting the River Lagan may be collected and diverted into the new system. The discharge of the sewage into the sea by means of the new works will only take place during the first portion of the ebb tide, so that advantage may be taken of the currents setting out towards the open sea.

The City of Birmingham.

Delegates to the Congress:

Councillor R. F. MARTINEAU.
ALFRED HILL, M.D., Med. Off. Health.

Birmingham is a parliamentary and municipal city and borough and county borough under the Local Government Act, 1888. The parliamentary borough includes the districts of Balsall Heath, Harborne, Saltley, and Little Bromwich, and returns seven Members to Parliament. The population of the city in 1881 was 400,774, and in 1891 it was 429,171.

The area of city is 8,420 acres. There are 205 miles of streets, 32 of which are paved, the remainder are macadamised.

The rateable value in 1890 was 1,817,638*l.*

The number of voters on the Burgess Roll, 1890–91, was 78,510, and the number of voters on the Parliamentary Register for 1891 was 76,157. The city is divided into 16 wards, each of which is represented by three councillors; an alderman is allotted to each ward to act as returning officer at municipal elections.

The city was incorporated in 1838; but not until the passing of the Birmingham Improvement Act, 1851, did the council obtain entire control of the borough, the formation and maintenance of streets, lighting, draining, &c., having until that time been in the hands of several bodies of commissioners. Birmingham was created a city in 1888.

A grant of assizes was made in 1884, and in 1887 the foundation stone of the courts was laid by Her Majesty the Queen.

The city is of considerable antiquity. The name first appears in history in Domesday Book (1083–1086), and it was then a place of some importance. Its great growth has, however, been recent, for the population in 1801 was but 73,670. The manufacturing industries of Birmingham are very varied, and are mainly connected with the hardware trades, of which the city is the chief seat.

The city is situated on the north-west of Warwickshire, at an elevation of 291 to 616 feet above sea level. The soil is of a porous and gravelly nature, and in parts sandstone rock. Its elevation and the nature of the soil have a beneficial effect on the public health. The general sanitary condition of the city is now good, and the powers of the council with respect to public health are vigorously administered. Owing in a great measure to this fact, the death-rate declined from 26·8 per 1,000 in 1874 to 17·5 in 1888, and the zymotic death-rate from an average of 5·3 per 1,000 during the five years 1873 to 1877 to 2·7 during the five years 1886–1890. The death-rate for last year shows an increase, being 22 per 1,000 on the estimated population. This increase is not, however, confined to Birmingham, the death-rate for the whole of England and Wales having risen to quite as great an extent, while that for the 28 large towns given in the returns of the

Registrar-General shows a larger increase than has occurred in Birmingham. The zymotic death-rate for 1890 was 2·8 per 1,000, and the birth-rate for 1890 was 29·9 per 1,000.

The Infectious Disease (Notification) Act, 1889, the Infectious Disease (Prevention) Act, 1890, and Part III. of the Housing of the Working Classes Act, 1890, have been adopted. The Corporation have a hospital for the treatment of small-pox and scarlet fever, with accommodation for about 400 patients. The sanitary department proper includes, in addition to the medical officer of health and the inspector of nuisances, 22 assistant inspectors. There are also two meat inspectors under the markets superintendent, and a special drain inspector and a building surveyor under the city surveyor. During the year 1890 22,727 notices were issued for the abatement of nuisances, 21,342 nuisances were abated, and in 57 cases only were proceedings taken against defaulters. There were 87 common lodging-houses on the register at the end of the year, registered for 1,959 lodgers, besides 128 houses registered as "houses let in lodgings" for 725 lodgers. Nine hundred and twenty-six samples were purchased under the Food and Drugs Acts, 123 articles were more or less adulterated, 29 persons were cautioned, and 16 summoned.

Sewerage.—There are 206 miles of sewers. The sewage is discharged at Saltley, and is dealt with on a farm of over 1,200 acres by a system of treatment with lime, of precipitation in tanks, and of filtration of the sewage through the land. The effluent water is afterwards discharged into the Cole and Tame. The farm is the property of the Birmingham, Tame, and Rea District Drainage Board, a body composed partly of representatives elected by the city council and partly of representatives of adjoining authorities. There are in all 22 members, of which the mayor of Birmingham and the chairman of the Aston Local Board are *ex officio;* of the others 11 are elected by Birmingham. The total area of these districts, the sewage from all of which is treated, is 45,000 acres.

Improvement Scheme.—Immediately upon the passing of the Artizans' and Labourers' Dwellings Improvement Act, 1875, the Corporation took steps to put it in operation. The area acquired under the Act (including a site for the erection of artizans' dwellings) was 218,099 square yards; this area has up to the present time been dealt with as follows:—Let on building lease to 31st March 1891, 48,076 square yards; sold or exchanged, 17,237 square yards; site of Victoria Courts, 5,600 square yards; site of 22 artizans' dwellings in Ryder Street, 2,100 square yards; site of 82 artizans' dwellings about to be erected, 6,783 square yards; required for new streets and widening old ones, 39,810 square yards; still occupied by rent-producing property, 84,152 square yards; cleared for letting, 14,341 square yards.

The annual rental receivable from the 48,076 yards let on building lease amounts to 36,021*l.* 10*s.* 3*d.*, and the property left standing produces about 20,000*l.* per annum.

About 1,867 houses and 814 other buildings have been acquired; of these, 890 houses and 353 other buildings have been taken down,

and the remainder repaired and put into a sanitary condition by removing buildings where too crowded, rebuilding the out-offices, paving the yards, providing a proper system of drainage, laying on the Corporation water supply, &c. Fifty-seven licensed premises were included in the above, and up to the present time these have been treated as follows:—Premises taken down and licenses abandoned, 19; premises taken down and licenses transferred to new buildings, 11; premises still standing and licenses continued, 27.

The total capital expenditure in respect of this scheme up to the 31st March 1891 amounts to 1,666,398*l.* 7*s.* 11*d.*; but by deducting the sum of 115,588*l.* 16*s.* 7*d.* paid to the sinking fund out of income, the actual liability is reduced to 1,550,809*l.* 11*s.* 4*d.* It is estimated that the outlay still to be incurred will entail the expenditure of a further sum of 50,000*l.* The actual cost to the ratepayers, being the annual instalments voted from the rates in aid of the scheme up to the present time, is as follows:—In 1876, 460*l.*; 1877, 6,147*l.*; 1878, 15,000*l.*; 1879 to 1886, 20,000*l.* per annum; 1887 to 1890, 25,000*l.*; and it is estimated that the scheme will entail a charge on the rates of 20,000*l.* per annum until the loans are paid off at the expiration of 60 years from the date of borrowing.

The Corporation have recently erected 22 artizans' dwellings at a cost of 4,000*l.*, and the houses are let at a rental of 5*s.* 6*d.* per week each. Eighty-two additional dwellings are now being erected, the estimated cost being 14,000*l.*, and it is intended to let these at the same rental.

Parks.—Birmingham possesses several public parks and recreation grounds, of which five have been presented to the Corporation.

The following is a list with particulars:—

Name of Park.	Date of Acquisition.	Area.	Gift or Purchase.
		a. r. p.	
Adderley Park - - -	1856	10 0 22	Gift of Mr. C. B. Adderley (now Lord Norton).
Calthorpe Park - -	1857	21 1 13	Leased to Corporation by Lord Calthorpe at nominal rent.
Aston Park and Hall - -	1864	43 0 0	Purchased for 26,000*l.*, 7,000*l.* of which was raised by subscription.
„ addition to - -	1873	6 2 8	Purchased for 4,750*l.*
Cannon Hill Park - -	1873	57 1 9	Gift by Miss Ryland.
Highgate Park - -	1876	8 0 28	Land purchased for 8,000*l.*, and 7,000*l.* expended in laying out.
Summerfield Park* - -	1876	12 0 20	Land purchased for 8,000*l.*, and 3,857*l.* expended for laying out.
Burbury Street Recreation Ground.	1877	4 1 3	Gift by Mr. Wm. Middlemore.
Victoria Park - -	1879	41 3 34	Gift by Miss Ryland.
Park Street Gardens - -	1880	4 1 35	Disused burial grounds; laid out at cost of 12,000*l.*
St. Mary's Gardens - -	1882	2 2 0	

* This park will shortly be increased by about 16 acres.

In addition to the foregoing, the Corporation are the possessors of a Hill (Rednal Hill, 32 acres), part of the Lickey Hills, a low range of about 900 feet in height, situated about eight miles from the City on the south-west. This hill was about to be let in lots on building leases when the Society for the Preservation of Open Spaces (T. Grosvenor Lee, Hon. Sec.), stepped in, and through its efforts sufficient subscriptions were raised for the purchase of nearly the whole Hill which has since been transferred to the Corporation. Another hill in the same range, Bilberry Hill (36a. 3r. 3p.), has been leased to the Corporation by Lord Windsor for a period of 21 years at a nominal rent. Both hills will be preserved in their natural state.

Baths.—There are four sets of baths belonging to the Corporation, the first of which was opened in 1851. Each suite consists of first and second class baths and private baths. There is also an open-air bath, and two sets of Turkish baths. The total number of persons using the swimming baths last year was 318,955, and of persons using the Turkish baths, 7,992.

Markets.—The markets consist of a market hall, fish market, dead meat market, covered vegetable market, cattle, sheep, pig, and horse markets, hay and straw markets, and several open-air vegetable and general markets. Their total cost (including 12,500*l.* purchase of market rights from the lord of the manor) was 235,000*l.* A further expenditure of about 60,000*l.* is contemplated in providing a new dead meat market and public slaughter-houses, and 12,500*l.* for the erection of a new pig market.

The total income for the year ending 31st March 1891, was 20,854*l.* 17*s.* 6*d.*; and the total expenditure 15,125*l.* 10*s.* 7*d.*; yielding a net income of 5,729*l.* 6*s.* 11*d.*

Education.—By the Corporation (Consolidation) Act, 1883, the limit of the Free Library Rate was removed, and power was given to the Corporation to establish a Municipal School of Art and to provide funds for the maintenance of the Art Gallery. Towards the erection of a School of Art. Miss Ryland gave 10,000*l.*, Messrs. Richard and George Tangye 10,000*l.*, and Mr. Cregoe Colmore gave the land worth 14,000*l.* The school was opened in 1885. In connexion with it there are 11 branch schools in various parts of the town. The total number of students on the books at end of 1890 was 2,456.

The Birmingham Museum and Art Gallery was opened in 1885. There is on view here a collection of oil paintings, water colour drawings, sketches, &c., as well as a large collection of iron and other metal work, stone, ivory, and wood carvings, tapestry, textiles, jewellery, &c. An Art and Natural History Collection is also open to the public at Aston Hall. The total number of visitors at both these places was 825,601 during the year 1890. The Art Gallery and Museum are open on Sunday afternoons.

A Technical School has been established by the Corporation under the Technical Instruction Act, 1889.

Other educational institutions in the City are the Birmingham and Midland Institute, Mason Science College, Queen's College, and the Grammar School.

The Birmingham and Midland Institute was established in 1854, for the diffusion and advancement of science, literature, and art, and lectures are delivered to the members by the best lecturers of the day, and popular classes are held in science, languages, commercial subjects, music, &c., open to persons of both sexes.

The Mason College was opened in 1880. In addition to the higher branches of collegiate learning, education adapted to the scientific requirements of the manufactures and industrial pursuits of the Midland District is given, also regular systematic instruction for the B.Sc. and D.Sc. of the University of London, and popular instruction by evening lectures, &c., for artizans and others.

Queen's College is devoted chiefly to medical and surgical study. It is about to be amalgamated with Mason College, except as regards its theological faculty.

At the Grammar School of King Edward VI., which has several branches, higher education is given to boys and girls.

There are few towns where the educational ladder is so complete. In the 52 board schools the curriculum includes, besides the usual subjects, science, cookery, carpentry, and manual training. From the board schools there are scholarships to the Grammar School and Mason College.

Free Libraries.—The Corporation maintain a central free lending library, reference library, and news room. There are also four branch libraries, each with a news room, and two other branches are in course of erection. The first library was opened in 1861. In the lending libraries there are upwards of 60,000 vols., and in the reference library there are more than 106,000 books. The number issued during the year from the reference library was 343,116, and from the lending libraries 504,575. The reference library is opened on Sunday afternoons and evenings.

Cemetery.—In 1860 the Corporation purchased 105 acres of land, of a light nature, at Witton, about three miles outside the City, for use as a cemetery.

The Gas Department.—The Corporation of Birmingham acquired by purchase in 1875 the Undertakings of the Birmingham and Staffordshire Gas Light Company and the Birmingham Gas Light and Coke Company. The area of supply includes, besides the city of Birmingham, the parishes of Edgbaston, Harborne, Northfield, King's Norton, Yardley, Sutton Coldfield, Handsworth, Aston, Darlaston, and Wednesbury, and portions of the parishes of Halesowen and Bickenhill. The area, at the time of the transfer to the Corporation, also included the

parishes of Smethwick, Oldbury, Rowley Regis, Tipton, West Bromwich, and Walsall, but in each of these districts the rights of supply have since been sold by the Corporation to the local authorities. The present area is about 18 miles from north to south and 12 miles from east to west. Within this district, 536 miles of mains have been laid, covering an area of about 12 by 10 miles, and supplying over 55,000 consumers and 12,200 public lamps.

At the time of the purchase the prices charged for gas were as follows:—

			s.	*d.*		
Under 10,000 cubic feet per quarter,			3	6	per 1,000	cubic feet.
10,000 to 25,000	„	„	3	4	„	„
25,000 to 100,000	„	„	3	2	„	„
Over 100,000	„	„	3	0	„	„
Public lamps -	-		3	0	„	„

All subject to 5 per cent. discount for prompt payment.

The prices now are as follows:—

			s.	*d.*		
Under 25,000 cubic feet per quarter,			2	7	per 1,000	cubic feet.
25,000 to 50,000	„	„	2	5	„	„
50,000 and upwards		„	2	3	„	„
Public lamps		-	1	1	„	„

All subject to 5 per cent. discount for prompt payment.

The gas works supplying this area are situated at Windsor Street and Adderley Street within the city, at Saltley within the district of the Saltley Local Board (about to be brought within the city boundaries), and at Swan Village in the parish of West Bromwich. The area of land occupied by and used in connexion with these works is about 96½ acres. The accompanying tables show the growth of the Undertaking and the application of its profits from the year 1875:—

Year.	Capital Expenditure to 31st December.	Coal Carbonised.	Gas sold and used on Works.	Gas Rental.	Price of Gas less 5% discount for Prompt Payment.	Average Net Price of Gas.	Residuals sold.			Amount of Reduction, Public Lighting.	Surplus Profit.
							Coke and Breeze.	Tar.	Ammoniacal Liquor.		
	£	Tons.	Cubic Feet.	£			£	£	£	£	£
1875	2,000,931	296,000	2,327,596,800*	—	3/ to 3/6	About 3/1¼	—	—	—	—	25,339
1876	2,084,530	299,396	2,386,565,800	344,144	2/9 „ 3/3	2/10·60	70,790	31,165	16,271	—	34,122
1877	2,131,751	287,899	2,380,217,800	342,614	2/9 „ 3/3	2/10·54	55,868	33,205	16,584	—	36,685
1878	2,131,442	297,884	2,494,495,900	357,678	2/9 „ 3/3	2/10·41	39,907	31,279	23,547	—	54,832
1879	2,153,336	318,083	2,645,296,200	346,709	2/6 „ 3/	2/7·45	41,339	33,196	38,199	—	51,166
1880	2,142,262	307,232	2,675,755,400	349,551	2/6 „ 3/	2/7·35	47,549	39,306	39,374	—	57,009
1881	2,096,110	309,134	2,747,865,400	325,008	2/3 „ 2/9	2/4·38	49,861	39,830	47,360	—	52,853
1882	2,127,726	301,491	2,716,588,400	319,630	2/3 „ 2/9	2/4·24	48,685	32,083	54,294	—	50,946
1883	2,190,875	311,886	2,861,072,000	336,275	2/3 „ 2/9	2/4·21	49,634	32,705	42,706	—	55,389
1884	2,274,095	323,050	2,953,697,800	327,982	2/1 „ 2/5	2/2·65	44,486	31,918	33,564	—	28,465
1885	2,313,222	343,156	3,151,878,000	332,145	2/1 „ 2/5	2/1·29	39,296	22,665	28,602	7,594	25,000
1886	2,328,014	350,734	3,298,746,000	344,211	2/1 „ 2/5	2/1·04	34,356	18,899	30,609	8,353	19,227
1887	2,294,340	359,415	3,378,555,000	377,778	2/3 „ 2/7	2/2·83	34,835	16,885	27,561	9,678	25,773
1888	2,241,271	372,665	3,482,923,800	387,842	2/3 „ 2/7	2/2·73	43,959	21,781	29,588	10,280	40,916
1889	2,211,065	390,128	3,618,777,800	401,696	2/3 „ 2/7	2/2·64	60,384	29,102	32,430	10,912	70,337
3 months ended 31 Mar. 1890	2,203,158 To 31st March.	120,808	1,255,637,600	138,273	2/3 „ 2/7	2/2·43	23,804	10,059	10,586	3,352	38,471
Year ended 31 Mar. 1891	2,178,407	421,710	3,910,418,300	423,059	2/3 „ 2/7	2/2·64	91,401	33,157	30,241	11,189	36,785

* About.

Year.	Appropriation of Net Profit.*				Amount of Reserve Fund at 31st December.	Amount of Sinking Fund at 31st December.
	Improvement Rate.	New Offices Account and other Public Purposes.	Reserve Fund.	Extra Contribution to Sinking Fund.		
	£	£	£	£	£	£
1875	—	950	24,389	—	—	—
1876	30,000	—	4,122	—	24,389	3,832
1877	25,000	—	11,685	—	29,499	7,934
1878	25,000	—	7,152	22,680	42,848	12,349
1879	25,000	—	—	26,166	50,000	40,549
1880	25,000	6,000	—	26,009	50,000	73,486
1881	27,500	—	—	25,353	50,000	107,670
1882	25,000	—	—	25,946	50,000	142,359
1883	25,000	—	5,000	25,389	50,000	179,241
1884	28,465	—	—	—	57,222	217,214
1885	25,000	—	—	—	59,534	227,144
1886	19,227	—	—	—	61,939	240,726
1887	25,773	—	—	—	64,441	254,868
1888	25,000	—	15,916	—	67,045	269,384
1889	41,649	—	13,638	15,000	86,312	284,494

* Exclusive of 31,072*l.* appropriated to New Offices Account from Gross Profit.

Water.—The Corporation acquired the Water Undertaking in 1875 at an estimated cost of 1,350,000*l.* The area of supply includes, besides the city, the parishes of Handsworth, Aston, Edgbaston, Harborne, Northfield, King's Norton, Yardley, Curdworth, Coleshill, Sheldon, Bickenhill, Elmdon, Solihull. This area is about 12 miles from north to south and 15 miles from east to west; within it there are 579 miles of mains supplying about 600,000 consumers. The average daily supply at time of purchase was 8·46 million gallons. It is now 15·73 million.

The supply is derived from the rivers Blythe and Bourne, Plant's Brook, Perry and Witton Brooks, and from six wells in the Sandstone rock. The area of the reservoirs is as follows:—

Reservoirs.	Water Area.			Contents.
	A.	R.	P.	Gallons.
SHUSTOKE:—				
Large Pool - - -	89	1	33	421,601,176
Small „ - - - -	9	0	14	20,286,505
Whitacre (Blythe Pool) - -	10	2	30	32,303,491
PLANT'S BROOK:—				
Large Pool - - -	10	2	35	27,153,219
Middle „ - - - -	2	2	9	3,795,387
Small „ - - - -	1	1	36	2,133,632

Reservoirs.	Water Area.	Contents.
WITTON :—	A. R. P.	Gallons.
Upper Pool - - -	6 0 30	10,958,283
Middle „ - - - -	12 3 2	25,124,559
Lower „ - - - -	17 1 12	29,697,850
Erdington - - - -	2 0 26	11,564,542
Perry - - - -	7 1 18	8,764,568
ASTON :—		
East Pool - - - -	2 0 20	7,071,014
West „ - - - -	2 1 9	6,657,131
EDGBASTON :—		
Upper Pool - - - -	2 1 1	6,505,742
Lower „ - - - -	1 1 34	4,147,814

Note.—By the City of Birmingham Order, 1891, confirmed by the Local Government Board's Provisional Order Confirmation (No. 13) Act, 1891, the boundaries of the City of Birmingham were, on November 9th, 1891, extended so as to include therein the Local Board Districts of Balsall Heath, Harborne and Saltley, and the Hamlet of Little Bromwich. These districts were previously included in the Parliamentary Borough of Birmingham. By this extension the population of the City has been increased from 429,171 to 478,116, and the area from 8,420 acres to 12,365 acres.

The Borough of Blackpool.

Blackpool is situated on the north-west coast of the county of Lancaster, about 18 miles from Preston and 49 from Manchester. It has been built on an exposed part of the coast, and receives the winds from all the westerly points of the compass in their full force. It is a place of most recent and rapid growth: some 75 years ago it was little more than a fishing hamlet, though even then well known for the healthful character of its situation and climate. Since that date it has greatly grown both in size and importance. During the last decade the population has increased by 67 per cent., and the rateable value by 70 per cent.

The town is now served by two railway companies, the Lancashire and Yorkshire, and the London and North-Western; a third line is projected, and it is hoped that in a few months the process of construction will have started. The busiest season of the year is comprised in the three months of July, August, and September, and during this period the town is so well patronised that at times the population is estimated to be over 70,000, exclusive of the excursionists who on Saturdays and Mondays flock into the town in great numbers. Though the "season" in Blackpool is so limited, the weather during the earlier months of the year is most delightful, and for certain diseases very beneficial. Thus in June the total hours of bright sunshine recorded on the average for the six years, 1885 1890, were 199·2 hours. This is the highest average for any month, whilst July comes next with an average of 181 hours. The average annual rainfall for the six years is 32¼ inches, but it is exceptional for rain to fall for a long period during any one day, and the ground dries rapidly. The driest months are April and June, with a rainfall of 1·57 inches each, and February comes next with a fall of 1·68 inches. The velocity of the wind has been recorded for the two years 1889–90 only, but from those observations it would seem that the winds are strongest in January, with a daily velocity of 490·7 miles, and least in May with a velocity of 317 miles per diem.

In 1851 the Layton-with-Warbrick Local Board was constituted, comprising by far the greater portion of the district now known as the Borough of Blackpool. In 1868 the name was altered to the Blackpool Local Board of Health district. In 1876 a Charter of Incorporation was granted, and the town divided into six wards, represented by six aldermen and 18 councillors. Under the Blackpool Improvement Act, 1879, the borough was extended so that its area, inclusive of the foreshore, is 4,243 acres, and exclusive of that portion, 3,495 acres.

In 1890 there were 5,044 inhabited houses within the borough. Whereas the resident population in 1881 was 14,229, it had risen to 23,846 in 1891. It is estimated that the resident population of the present borough at the census of 1861 was 3,907, and at that of 1871, 7,092. The rateable value in 1891 was 175,883*l.*

Main drainage works were first commenced in the borough in the year 1866, and have been added to and improved upon from time to time,

especially by the diversion of a stream called Spen Dyke into the sewage outfall. These works up to the present time have cost 45,709*l.* The length of main sewers within the borough is 10 miles. The sewage is discharged into the sea by one main outfall which is carried out to sea as far as possible beyond the influence of the tide, and also by a smaller one at the most northern part of the borough. During the last few years great exertions have been made to place the town in a thorough sanitary condition by the employment of experienced drain-testers, who are making a house-to-house survey of the town in order to discover any sanitary defects, and who submit the drains of each house to the trial of a smoke-testing machine. This is in addition to the examination of any house of which complaint is made, or where infectious disease breaks out. The borough surveyor does not now give a certificate to the effect that a new house is habitable until the drains have satisfactorily withstood the smoke-test, as testified by the medical officer of health.

Along the sea front a wide and beautiful promenade has been constructed, 3,440 yards in length, at a cost of 79,013*l.*; its seaward slope is faced with large blocks of stone, and is known as the hulking. During the season this has been found too narrow in its central portion for the large amount of vehicular and pedestrian traffic between the two piers, so that it is now contemplated to widen it. Besides the two large piers, north and south, just mentioned, a third at South Shore is to be constructed during the coming winter. Over about 2 miles of the promenade electric tramcars run throughout the day, the current generated at the central depôt being conducted by an insulated copper bar contained in a channel in the centre of the track, and being picked up thence by a tongue of metal attached to the car and passing through the slot in the roof of the channel. This tramway has been working since 1885. Further, during the season the promenade and the two piers are lighted by the electric light from 11 Siemen's burners placed at a height of 50 feet. These were first installed in 1879, and have cost 3,570*l.* Under the Blackpool Electric Lighting Order, 1890, the Corporation have secured powers to adopt electricity in the lighting of the streets of the town generally, and for domestic and business purposes. The Corporation, except as to a small portion of the town, are the gas undertakers, and supply that illuminant at 2*s.* 6*d.* per 1,000 cubic feet.

The streets of the town are kept in good order. The promenade is paved with large "setts," the only pavement which has up to the present been found to withstand the sea at Blackpool. In the other streets macadam, asphalt-macadam, and stone setts are used. An experiment has lately been made in one part with wood pavement. There are in the borough about 13 miles of county roads and 17 of public streets, besides 8 miles of private streets not yet taken over by the Corporation.

The borough and surrounding districts are supplied by the Fylde Waterworks Company. This water comes fully up to the standard of an upland peaty water, and is collected from the moorland around Grisedale. At times, however, the water has a deep-brown hue, and may even be turbid. This is not believed to be deleterious to health,

SKETCH MAP
OF
BLACKPOOL.
RAILWAY
LYTHAM
AND
BLACKPOOL
PROMENADE
SOUTH PIER
NORTH PIER
RAIKES HALL
PROMENADE
NEW ROAD
PRESTON & WYRE RAILWAY
PROMENADE
IRISH SEA

and can be easily rectified by proper filtration of the water at the collecting grounds. Owing to a very active opposition made by the Blackpool Corporation and the neighbouring urban authorities of Fleetwood, Lytham, and St. Anne's-on-the-Sea to a private Bill promoted by the Water Company in the last session of Parliament, the filtration of water must in future be efficiently carried out by the Company. By the same Bill the gathering ground has been increased, and by next season it is hoped there will be an ample water-supply against which no objections can be legitimately made.

A suitable site, with land for a railway siding, has been purchased, and the sanction of the Local Government Board to a loan of 4,000*l.* for the erection of public slaughter-houses has been granted.

For the decade 1881–1890 the birth-rate is 27·4 and the death-rate 16·2 per annum for every 1,000 persons living. (The death-rate is corrected by the subtraction of all cases of death occurring amongst visitors to the town.) The deaths from the seven principal zymotic diseases average 1·9 per 1,000, and during 1890 these deaths were chiefly due to diarrhœa. Taking into account the character of the residents and the healthiness of the district the infant mortality is high, being 181 per 1,000 births registered during 1890, and 155·7 for the years 1881–1890.

The infectious diseases (small-pox, infectious cholera, measles, typhus, typhoid, scarlet, relapsing, and puerperal fevers, and diphtheria) have been notified since 1879. Power to make this notification compulsory both on the householder and the medical attendant was given by the Blackpool Improvement Act, 1879. The results attained have been excellent, and the authorities have found very little difficulty in its administration even in the early days of its inception. The recently erected hospital for the isolation and treatment of infectious disease is admirably equipped and arranged for its purpose. There is a large house for the matron, containing doctor's consulting room and accommodation for a few cases whose exact diagnosis is doubtful or in which the patient's friends refuse to have the patient placed in a ward along with others. There are two blocks; one block being divided so as to preclude direct communication between its two portions. Each of these portions, like the second block, consists of two wards with a nurses' kitchen between; thus there are altogether six wards, so that, if necessary, three separate diseases in each sex could be treated and isolated at the same time. The grounds around the building are ample and very tastefully laid out. Twenty-six patients can be accommodated in the hospital at one time. A hospital for accident cases and for non-infectious diseases is about to be erected on a convenient site by means of voluntary subscriptions.

There is a well-managed Free Library in the town, supported by less than the 1*d.* rate under the Free Libraries Act. The Corporation also intend to put into operation within the borough the power and benefit of the Technical Instruction Act, 1889.

The Borough of Bournemouth.

Delegates to the Congress.

T. J. Hankinson, Mayor.
F. W. Lacey, A.M.I.C.E., Borough Surveyor.
Philip W. G. Nunn, L.R.C.P., Lond., M.R.C.S., M.O.H.

The municipal borough of Bournemouth is situate on the south coast, at the western extremity of the county of Hants, midway between the towns of Poole and Christchurch. It is included in the parliamentary borough of Christchurch. The town is divided into two portions by a small rivulet, called the Bourne, which rises in the parish of Kinson, between six and seven miles distant from the sea.

The pine trees are a great feature in the town. They are more numerous on the East Cliff, but on all sides of the town there are extensive pine woods. These contribute, in a great measure, to its reputation as a health resort. For many years past the governing authorities have endeavoured to make the town perfect in its general sanitary arrangements, and it is now generally admitted that it deserves a high character for its sanitary condition.

Climate.—With regard to the climate of Bournemouth, whilst the value of its winter season has an established world-wide reputation, the advantages of the summer season are still much less widely known than they ought to be. It is commonly inferred by strangers that inasmuch as Bournemouth is an excellent winter health resort, it must be a very hot place in summer, whereas the coolness of the summer here is certainly a very remarkable and interesting fact.

With reference to extremes of heat in summer, it appears from a series of observations taken continuously for the past 24 years in the district by Dr. T. A. Compton, of Southbourne, that a temperature of 80° Fahr. in the shade has never been recorded in May or September, whilst it has only been reached in three Junes, in eight Julys, and in eight Augusts out of the 24. A temperature in excess of 83° Fahr. was recorded in three months only in the 24 years, viz., in July and August 1876, and in July 1886; the actual maximum, 87½°, of the 24 years having been attained in July 1886. These temperatures being from 10° to 15° below the corresponding ones at Greenwich, the summer coolness of Bournemouth cannot be denied. This coolness of air in summer has not been due to prevalence of cloud, for the average number of hours of bright sunshine registered by "Campbell's Sun Recorder" in the past 11 years (since the instrument was set up) has been as follows in the three hottest summer months of June, July, and August: June, 195 hours; July, 204 hours; August, 196 hours. Whilst bright sunshine* has occurred, on an average, on 27 out of 30 days of June; 29 out of 31 days of July; 29 out of 31 days of August.

* The term "bright sunshine" is used on account of the fact that Campbell's Sun Recorder does not register the total amount of sunshine, such, for instance, as the majority of that which passes through visible cloud. Generally speaking, the instrument registers sunshine whenever a person with ordinary eyesight cannot look at the sun.

No doubt, the coolness of the bright summer days is greatly due to the prevalence of the local sea breezes, which, in fine weather, generally set in about 10 a.m., and continue until late in the afternoon.

The average annual rainfall of the past 24 years has been 28·73 inches, falling on an average of 162 days. The average annual amount of bright sunshine has been 1,550 hours in the 11 years since the introduction of the recording instruments; the average number of days on which bright sunshine has occurred having been 290.

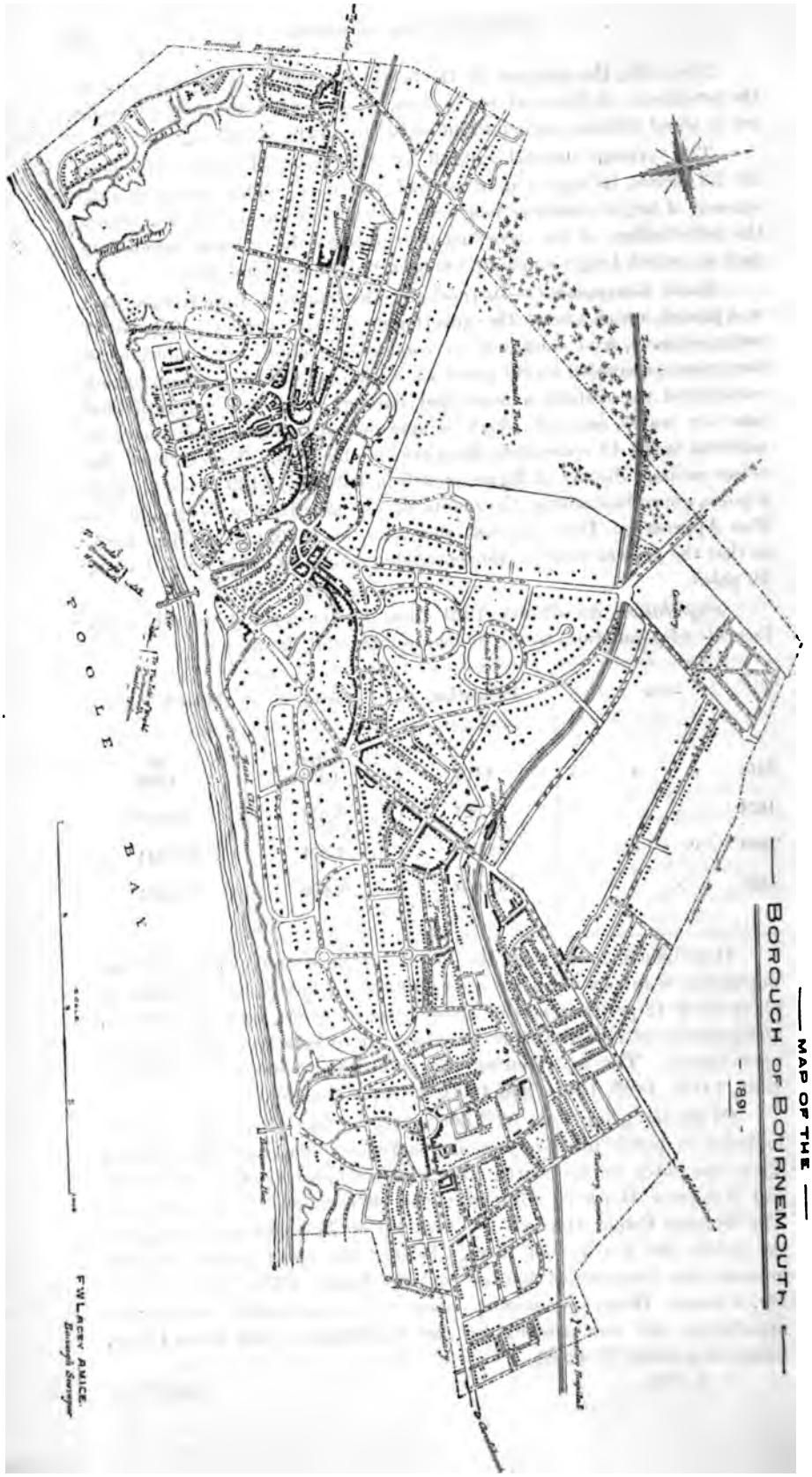
Local Government.—In 1856 the Bournemouth Improvement Act was passed, which vested the government of the district in a board of commissioners, who continued to conduct its affairs until 1890, when they were superseded on the grant of a charter of incorporation, which constituted the district a municipal borough. The borough is divided into six wards, each of which is represented by three councillors; in addition to the 18 councillors there are six aldermen. The area of the urban sanitary district of Bournemouth in 1856 was 1,139 acres, 2 roods, 8 poles, comprised within the radius of one mile from a centre in the Pier Approach. This area was increased in 1876, and again in 1884, so that the present area of the borough amounts to 2,660 acres, 1 rood, 20 poles.

Population, &c.—Since 1861 there has been a continuously rapid increase of population, as the following table will show:—

—	Population.	Area.	Rateable Value.
		Acres.	£
1861 - - -	1,707	1,391	4,923
1871 - - -	7,027	1,391	30,306
1881 - - -	18,533	1,671	117,341
1891 - - -	37,650	2,660	268,865

It is difficult to estimate the death-rate of a district in which the population is subject to such varying influences, but it may be taken at about 10 to 12 per thousand of those properly belonging to the district, and inclusive of visitors (many of whom arrive with their fatal illnesses upon them). The rates during the past three years are as follows: 1888, 14·0; 1889, 12·7; and 1890, 15·5 per thousand.

Of the foregoing area of 2,660 acres, no less than 240 acres are included in public pleasure grounds, parks, commons, and open spaces. There are public tennis courts, 10 in number, in the Central, Boscombe, and Knyveton Gardens, with lavatories, dressing-rooms, &c., to each. The Durrant Estate Gardens are kept up by Miss Durrant, who gives the public the free use of them. Besides the above public pleasure grounds the Corporation has secured the Durley Chine by gift from Mr. Cooper Dean, comprising about seven-and-a-half acres; and negotiations are now pending for the acquisition of the Alum Chine, comprising about 22 acres.


MAP OF THE
BOROUGH OF BOURNEMOUTH
1891
POOLE
BAY
F.W. LACEY A.M.I.C.E.
Borough Surveyor

Roads.—The public roads and streets are about 52 miles in length, and the private roads or highways, not repairable by the inhabitants at large, about 12 miles; of the former, 3¾ miles are main roads, and were maintained during the year ending March 1891 at a cost of 4,709*l.* 16*s.* 11*d.*, exclusive of footpaths, or at the rate of 1,305*l.* 6*s.* 8*d.* per mile. The metalling used on this road is picked flints and Mendip lime-stone. The other roads are metalled with gravel dug from the pits in the neighbourhood. The paths through the principal streets are paved with Limmer asphalte, and the majority of other paths within the district with lime-stone tar paving. The total length of paved paths in the district is as follows: Limmer asphalte, two miles; tar paving, 29 miles.

Water Supply.—The water supply is derived from the water-bearing strata in the valley of the River Stour, and collected by means of brickwork culverts. From the sump in connexion with these culverts, two 100-h.p. Worthington pumps, each capable of pumping about 1,836,000 gallons per day, and one Turbine, capable of lifting about 576,000 gallons per day, are used as required in forcing the water through an 18 in. rising main to the aerating works and filtering beds at Alderney Manor; from thence the water flows to Bournemouth by gravitation. In connexion with these works there is a reservoir 203 ft. above ordnance datum, the capacity of which is 3,000,000 gallons. The level of the town varies from about 20 ft. to 130 ft. above ordnance datum.

Sea-Water Scheme.—A system of sea-water mains, consisting of about 11 miles of cast iron distributing mains from 3 in. to 6 in. diameter, and supplied by means of two 9-h.p. Nom. gas engines, pumps water from the sea through water towers 170 ft. above ordnance datum for road watering and sewer flushing purposes. This system, adopted in 1888, is now being considerably extended, with a view to a perfect system of sewer flushing referred to hereafter, necessitating the laying of an additional nine miles of mains and increased steam pumping plant.

Lighting.—The public streets are lighted by means of 940 public gas lamps, of an average of 12 candle power each, and 23 large public lamps, of an average 84 candle power each; the former are paid for according to the average meter system, and the larger ones according to the actual gas consumed. The total gas consumed in the year ending March 25th 1891 was 9,558,078 cubic feet, at a cost of 1,505*l.* 1*s.* 9*d.*, exclusive of lighting, extinguishing, cleaning, and maintenance, which cost 1,092*l.* 4*s.* 1*d.*, making a total of 2,597*l.* 5*s.* 10*d.*, or an average for each lamp of 2*l.* 12*s.* 11*d.*

The Brush Electrical Engineering Company, Limited, established the electric light in Bournemouth, and at the present time no less than 3,300 lamps of eight candle power are connected with the system. The electric supply is on the alternate current transformer system. The cables are partly over-head at present, but are being gradually placed underground.

Hospitals, &c.—The district is well provided with hospitals of all kinds, the following being a list of the principal institutions: A National Sanatorium for the reception of consumptive cases and diseases of the chest from all parts of the United Kingdom; the Royal Victoria Hospital, on the West Cliffe, and the Boscombe Hospital, at the eastern end of the town, affording the needed help to the local population; the Firs Home for incurable consumptives; an Invalid Ladies' Home for ladies in reduced circumstances; the Hip Hospital for Children (a branch of that in Great Ormond Street); the Herbert Home for Convalescents; the Hahnemann Convalescent Home and Homœopathic Dispensary.

There are two well conducted institutes for trained nurses.

The above hospitals are kept up by public subscriptions, and in part by small endowment funds.

A hospital for the proper isolation of cases of infectious disease was erected by the urban authority in 1887, on a site known as the Shaftesbury Estate, admirably isolated. The soil is of a dry gravelly character, 130 feet above ordnance datum; the grounds are about three-and-a-half acres in extent. The buildings consist of an administrative block (containing accommodation for a surgeon and matron), ward pavillion (containing two large and two small wards with accommodation for 10 beds, and quarters for two nurses), mortuary, ambulance shed, laundry, disinfecting room, and stable.

The dimensions of the smaller wards are 18 ft. by 18 ft., with a cubic space of 2,187 ft. for each patient. The dimensions of the larger wards are 18 ft. by 30 ft., with a cubic space of 2,340 ft. for each patient. In all parts of the building everything has been constructed on the best sanitary principles, and the ventilation is of the most approved description. At the head of each drain is placed one of Field's Patent Automatic Flushing Tanks. A Washington Lyons Patent High Pressure Steam Disinfector has been erected in connexion with the hospital, and as a means of preventing the spread of infectious disease it has been found most useful.

Drainage.—For drainage purposes the borough is much favoured by its natural formation, the district consisting for the most part of a table land about 130 ft. above ordnance datum, divided by three distinct valleys, forming three drainage areas or systems as follows:—Alum Chine at the western end, the Bourne Valley in the centre, and Boscombe Chine at the eastern end of the borough.

The sewers are constructed of glazed stoneware pipes, from 9 in. to 18 in., for the collateral and branch sewers, and of brick and iron for the main lines. Each of the three drainage systems discharges its contents into the sea by means of iron outfalls, the total discharging capacity of which in 24 hours is 45,820,455 gallons. Plans have been adopted by the Corporation for providing additional storm outfalls with a further capacity of 87,517,368 gallons per 24 hours.

The estimated total flow through the sewers at present is as follows:—Dry weather flow about 1,200,000 gallons. During storm, allowing 1½-in. rainfall, half to fall in six hours, about 40,500,000 gallons per 24 hours.

The ventilation of the sewers is effected by means of 6-in. wrought iron galvanized pipes carried up trees and walls of houses, and 6-in. wrought iron standard ventilators fixed in the kerb or other suitable positions throughout the district.

The flushing of the sewers is receiving the greatest possible attention from the Corporation, and the 20 miles of sea water main before referred to are at present used for this and road watering purposes only. In connexion with these mains there are 45 automatic flushing tanks at the dead ends of sewers, with a discharging capacity of 600 gallons in from 1¼ to 3 minutes after starting. In addition to these automatic flushing tanks, the dead end of every sewer in the district (104 in number) is being connected with the salt water mains, and fitted with a 3-in. sluice valve, by means of which every sewer can be flushed daily, as desired, by simply turning a handle. The discharging capacity of these 3-in. valves varies from 200 to 600 gallons per minute. This complete system of flushing the sewers also enables the Corporation to thoroughly and effectually disinfect the sewers by mixing appropriate disinfectants whenever required. The borough is provided with 14 public urinals, fitted with w.c.'s, &c. Four of these are constructed underground on the most approved principles in glazed bricks. There are also ladies' w.c.'s. fitted with lavatories, &c.

Destructor.—The house refuse from the principal streets and thickly populated parts is collected daily, and from the outlying districts once or twice a week, as experience has proved necessary. It is carted in closed carts and vans to the destructor, situate on the verge of the borough, where it is cremated, leaving 25 per cent. of the original matter as a residue consisting of hard clinker, suitable for making roads, concrete, etc. The total number of loads consumed in 1890 was 6,068. The destructor consists of six cells with "fume" cremator attached.

Pier.—The present Pier, constructed by the Bournemouth Commissioners from designs of the late Mr. Eugenius Birch, C.E. and completed in August 1880, has cost 28,300*l.*

Bathing Stations.—The Bournemouth shore consists of extensive sands, clean and dry, and eminently suited for bathing (the slope being so gradual that the most inexperienced may bathe with safety), along which the Corporation have nine public bathing stations, including two for females. There are also bathing-machines provided by private enterprise at convenient places on the beach.

The borough is otherwise well provided with bathing establishments of all descriptions, amongst which may be mentioned the Mont Dore and Messrs. Roberts and Co.'s Baths, including Swimming, Turkish, Electric, Sea Water, Pine Baths, &c.

Amongst the important Public Works in contemplation at the present time besides the Central Rendezvous and the extension of the Pier, are the Undercliff Drive and Promenade at an estimated probable cost of about 40,000*l.*; New Municipal Buildings; Electric Lighting of Pier and Pleasure Grounds, from power derived from the engines in connexion with the Sea-Water Scheme.

The Borough of Brighton.

Delegates to the Congress.

Alderman S. H. Soper (Mayor).
Alderman Ewart, J.P.
Councillor Blaker.
Arthur Newsholme, M.D., Medical Officer of Health.

Brighton lies on the east side of a shallow bay, with a south-south-west aspect towards the sea, and protected behind in a large measure by the South Downs. Two ranges of hills lie behind the town, and on the gradual slopes of these towards the sea, Brighton is chiefly built.

The Dyke district is situate on the summit of one of these hills, and is thus more fully exposed to the prevalent winds than other parts of the town. These two ranges of hills are separated by valleys leading from the Old Steine at its junction with the sea, in the shape of a Y, to Preston and Lewes respectively, and a considerable portion of the town is built in these more sheltered valleys.

The chalk cliffs at the Kemp Town end of Brighton reach from 60 to 80 feet above the beach, and the Madeira Road below these forms one of the most sheltered and sunny parts of Brighton. Its attractions for invalids are now still further enhanced by the covered esplanade, shelter hall, lift, &c., which have been erected. The hills behind the town reach in some parts to a height of 460 feet, the west range sloping more gradually to the sea beach than the eastern range.

There is no river within six miles of Brighton; and this fact, conjoined with the fact that in the greater part of its area the subsoil is a porous chalk, and everywhere slopes towards the sea, explains the great dryness of the Brighton soil and air, its comparative freedom from fog, and the fact that even after a heavy rainfall, its roads are rapidly dry and clean.

The chalk gradually thins out to the westward of Brighton, and when we get further west than a line from the sea to Montpelier Road, patches of clay appear. Still further west, brick-earth forms the entire superficial stratum of soil, but the gradual slope of the soil and the thorough character of the drainage prevent any accumulation of moisture.

Next to exposure and soil meteorological factors require consideration, and the following, stretching over a series of years, are of importance. Taking an average of 21 years, the highest mean daily maximum temperature in any month has been 70·5°, and is attained in July; the lowest mean minimum, 34·9°, in January. The mean daily range of temperature was only 11·8°, the lowest mean range being 7·7° in January, and the highest, 15·9° in June. The mean maximum

temperature for the whole year was 55·7°, the mean minimum 43·9°. The month of least humidity is May, when the mean humidity of the air is 72 per cent.; the highest is 91 per cent. in January and February. The most rainy month is November, with a mean rainfall of 3·40 inches; the driest month March, with 1·67 inches. The average annual rainfall is about 28 inches. The annual number of days on which rain fell averaged (in 20 years) 163 days; May and June are the two months in which the least rainfall occurs. The prevalent winds are westerly. Thus during 1890, on 14 days the winds was north, on eight days east, on 27 days south-east, on 12 days south, on 101 days south-west, on 27 days west, on 70 days north-west, and on 40 days a calm. The number of days on which rain fell in 1890 was 142, and the amount collected 23·6 inches. The duration of bright sunshine has probably a greater influence in determining the desirability of a given place for wintering than minor differences in extreme or mean temperatures.

Brighton shares, with other places on the south coast, a considerably longer duration of bright sunshine than other parts of England, and this preponderance is more marked during the winter than during the summer months. Thus during 1889, the Campbell Stokes sunshine recorder gave a record of 1,709 hours of bright sunshine; and of 1,700 hours during 1890.

The area of the Municipal Borough of Brighton is 2,620 acres. The population in 1801 was 7,339, in 1811 it was 12,012, in 1821 it was 24,229, at the present time (June 1891) it is 115,606. The death-rate in 1882 was 21·8, and in 1889 it had fallen to 16·1 per 1,000 inhabitants. The death-rate has been lower than any of the other 28 great towns for the last seven years. The death-rate from enteric fever has steadily declined from 0·21 per 1,000 inhabitants in 1882 to 0·10 in 1890. The death-rate from scarlet fever and from diphtheria is also extremely low.

The sanatorium or fever hospital is situated on an isolated portion of the Downs, and the majority of the infectious cases occurring in the town are isolated here. There is accommodation for over 100 patients. The hospital is built upon land embracing altogether 10 acres. The land cost the Corporation 5,000*l.*, the buildings, 13,193*l.*

The Infectious Diseases (Notification) Act came into operation in the present year; certain clauses of the Infectious Disease Prevention Act, and of the Public Health Amendment Act have also been adopted. The Brighton Local Improvement Act of 1884, incorporated a number of powers beyond these contained in the Public Health Act of 1875, which have been of the greatest service in bringing the sanitary administration of the town to its present high standard of efficiency.

The general sewerage system of Brighton was planned by Mr. P. C. Lockwood, C.E., for many years the borough surveyor. By means of an intercepting sewer, planned by the late Sir John Hawkshaw, and running directly east and west, the sewage is carried under the main road facing the sea to Portobello, its outfall being four miles distant from the most easterly point of the borough. Every sewer in the side streets is flushed in a most efficient manner weekly, and by this means

and by free ventilation of the sewers, freedom from nuisance is secured. House to house inspection is systematically carried out in every part of the borough, in order to ensure compliance with all sanitary requirements, and a staff of eight sanitary inspectors is constantly engaged in this and allied work.

The water supply of Brighton is unlimited in quantity, being derived from borings and tunnellings from the bottom of wells sunk in the chalk to the level of the subterranean water which is finding its way in the chalk towards the sea. At the Goldstone Bottom Waterworks, the shaft is about 150 feet deep, and lateral tunnels run from this to a length of 2,600 feet, tapping the fissures in the chalk through which the water runs. Like all waters filtered through chalk, the Brighton water is slightly hard. In 100,000 parts of water temporary hardness is represented by 12·1 parts, and permanent hardness by 7·3. In a manufacturing town this amount of hardness would be unfortunate, but in a health resort it is rather advantageous than otherwise. The water is palatable and agreeable to drink, very fully aerated, and free from traces of organic matter.

Two large public baths have been provided by the Corporation at the expense of 12,200*l.*, and other baths have been opened for the public on the cottage system.

Two parks are devoted to the use of the public, Preston Park with an area of about 62 acreas, which was acquired at a cost of 50,000*l.*; and Queen's Park with an area of 17½ acres, which has been given to the town by the trustees of the Race Stand. There are other recreation grounds including the Race Ground, which has an area of 105 acres, the Level Enclosure 10½ acres, and the Old Steine Enclosures, about 2 acres.

The Royal Pavilion and Dome were acquired by the town commissioners, the predecessors of the corporation, from the Commissioners of Woods and Forests, at a cost of 53,000*l.*, and are used for official receptions, concerts, balls, &c. The public library, to which is attached a free lending library, the art gallery, and museum are situated on the same premises.

The "Booth" Museum of birds in the Dyke Road has been recently bequeathed to the town. It is a very fine collection, embracing the whole of the British birds.

The sea front and marine drive is about four miles in length.

The County Borough of Cardiff.

BY

W. HARPUR, M. Inst. C.E., Borough Engineer.

Delegates to the Congress.

Alderman T. W. JACOBS, J.P.
Councillor J. RAMSDALE.
EDWARD WALFORD, M.D., Medical Officer of Health.
WM. HARPUR, Borough Engineer.

The county borough of Cardiff is situated on the banks of the River Taff, in the county of Glamorgan, and is bounded on the south by the Bristol Channel, on the east by the River Rumney, and on the west by the River Ely.

Cardiff, as its name indicates, is a town of great antiquity. Its existence can be traced back to the time of Aulus Didius, who in the first century established a Roman station at the mouth of the River Taff. That station was maintained until the withdrawal of the Romans from Britain three centuries later. Amongst the invaders the place was known as Castra Didii (*Anglice*, Didius' Camp); but the natives called it Caer Didii, which name, slightly modified by the natural mutations of the Celtic tongue, it bears to the present day; for though corrupted by the English residents into Cardiff the name is still pronounced Caerdydd (kairdeedh) by the descendants of those patriotic Cymru who waged war against Didius and his Roman legionaries 1800 years ago. Of its pre-Roman history nothing definite is known; but the commanding position which it occupies, and the fact that some of the earthworks of the castle are of British construction, strongly favour the presumption that Cardiff was an important and fortified place before the Romans landed on British shores.

From the withdrawal of the Roman troops down to within very recent times, the history of Cardiff is comprised in the story of the castle and its successive owners. For 600 years, from the end of the fifth to the end of the eleventh century, a succession of Welsh princes held sway in Cardiff, fiercely contesting the incursions of the Saxons and the Danes, as their fathers had resisted the invasion of the Romans.

In 1080, Jestyn ap Gwrgan, the last of the lords of Morganwg, is said to have built largely at Cardiff. It was in consequence of his ill-advised alliance with the Norman invaders of England that the lordship of Morganwg finally passed out of native hands in the year 1090.

The town has received many important charters; the oldest extant is one of Hugh le Despenser, in the reign of Edward III., dated 14th October 1388.

The central portion of the town was originally enclosed by a substantial wall, but with the exception of one or two small sections, nothing of it now remains, while the castle has been restored greatly extended and altered by the owner, the Marquis of Bute, now (1891) Mayor of Cardiff. One of the most important historical incidents in connexion with the castle is the reported confinement of Robert, Duke of Normandy, who was deprived of his sight and confined for 26 years in a small room at the base of the entrance tower.

One of the principal subjects deserving attention is the astonishing progress which has of recent years taken place in the commerce and population of the town, a progress which the recent census returns show has been unexampled in Great Britain, and one which has rendered Cardiff the metropolis of Wales.

In 1811 the population of Cardiff was only 2,577 ; but from that time it went on steadily increasing until in 1871 it had reached 39,536. During this time the area of the municipal borough was 2,791 acres, but under the powers of the Cardiff Improvement Act of 1875, the districts of Canton, Roath, and Grangetown were added to the borough, and the area thereby was increased to 8,409 acres, its present dimensions.

Owing to the foregoing extensions of the borough boundaries in 1875, as well as to an increased prosperity in the commerce of the town, it was found, when the census was taken in 1881, that the population had increased to 82,761, or an addition in 10 years of 43,225 ; but this great increase in population, largely due to the extension of the borough boundaries, has been continued during the past 10 years without any extension of the borough boundaries, for the returns of this year's census shows the population to have increased by 46,088, the last returns being 128,849, or an increase in the 10 years of 55·7 per cent. upon the population of 1881.

The coal and iron trades are the mainspring of the commercial prosperity and rapid growth of Cardiff, large docks having been constructed by the Marquess of Bute and his late father for the export of the immense quantities of coal raised and iron and steel manufactured in the valleys of the "Taff" and "Rumney."

The Glamorganshire Canal leading down the valley of the Taff to the "Sea Lock," was opened in 1798, and no further accommodation for shipping was provided until 1839, when the West Bute Dock, which has a water-surface of about 18 acres, and 8,800 feet run of quays, was opened for traffic, and was the first great undertaking which stimulated the rise of Cardiff. In 1859, the completion of the East Bute Dock added a further dock area of 46½ acres, and an additional 9,360 feet run of quays. Subsequently, the Roath Basin was constructed, with an area of 12 acres and 2,700 lineal feet of quayage; and in 1887, the Roath Dock, having an area of 33 acres and 7,520 feet run of quays was opened for traffic, and already the merchants are pointing out the immediate necessity for, and urging the construction of, further docks.

The port of Cardiff has now achieved the distinction of being the first port in the world for the volume of its foreign exports.

In addition to the docks mentioned, there are several large graving docks, engineering and ship repairing works, paper mills, copper works, and numerous other smaller industries, principally of a mechanical character; and the Dowlais Iron and Steel Company are now establishing large works for the manufacture of steel. The first portion of these works was opened in January 1891.

Upon the adoption by the town council in 1849 of the Local Government Act of 1848, Cardiff started upon a period of public improvement, which has gone on ever since, and is still going on, and is telling greatly to the health, comfort, and enjoyment of the people.

Extensive drainage works were commenced in 1853, and from that time until the present have been continued and extended as time and necessity required. The amount expended by the corporation for sewerage works upon capital account has been 135,611*l.*, and this sum has been very largely added to by the landowners, who in laying out their lands for building purposes are by a local Act required to sewer all new streets at their own cost.

The configuration of the site upon which the town lies is almost flat, and consequently the question of sewerage has been a difficult one. A large portion of the town is built upon a level with high-water mark of ordinary spring tides, and the sewers (which discharge into the Bristol Channel) are of necessity some depth below the surface of the ground, and, consequently, all the sewers are tide locked for some time before and after high-water of all ordinary and spring tides; and in order to store the sewage when the tide-valves are closed, large sewers are provided which act as storage reservoirs until the tide recedes, when the contents are discharged.

The evenness of the surface of the ground has also rendered the question of obtaining suitable gradients for the sewers a difficult one, some of the gradients being as slight as 1 in 2,000. Notwithstanding these difficulties, however, Cardiff is well and efficiently sewered, and few towns can boast of as good a system of sewerage. The smallest sewers are egg-shaped, built in brickwork, and the internal dimensions are 3 feet by 2 feet, and the total length of sewers in the borough at the present time is about 75 miles.

Up to the year 1850 the town was dependent for its water upon various private and public wells. In that year an Act was obtained by the Cardiff Waterworks Company, empowering them to construct works near the River Ely, about three miles from the town. The water is derived from the dolomite formation of the old red sandstone taken into culverts running alongside the River Ely, and then pumped into service reservoirs for the supply of the town and district.

In 1860 the company obtained further powers, enabling them to take the waters of various streams on the limestone gathering grounds at Lisvane, three to four miles from Cardiff, and to construct at

Lisvane a storage reservoir holding 80,000,000 gallons of water, together with filter-beds, the town being supplied from this source by gravitation.

In the year 1879 the Cardiff Corporation obtained an Act of Parliament empowering them to purchase the whole of the existing water undertaking from the company, and the purchase of the works was shortly afterwards completed, the amount paid to the company being 320,000*l.*

It was found that the existing works would soon prove inadequate to meet the increasing consumption of water, owing to the very rapid growth of the town and district; and after an exhaustive inquiry into the merits of several sources for future supply, it was decided to promote a Bill in Parliament to obtain water from the Taff Fawr Valley in Brecknockshire, situate on the old red sandstone formation about 30 miles from Cardiff.

In order to meet the pressing needs of the town, another large storage reservoir was commenced at Llanishen in 1884 and completed in 1886, adjoining the existing Lisvane Reservoir, capable of holding 300,000,000 gallons of water.

New filter beds for efficiently filtering 3,000,000 to 4,000,000 gallons per day on the most approved principles, with land for future extensions, were built near the "Heath," a mile and a half from Cardiff, at the same time as the storage reservoir at Llainshen.

In the meantime, the Act authorising the works in the Taff Fawr Valley was obtained, and contracts for the work let in the year 1886, since which time over 300,000*l.* has been expended thereon. Owing to unforeseen circumstances in connexion with the first storage reservoir, and to difficulties with the contractors, the town has not yet had the Taff Fawr water supplied, but it is confidently expected that the reservoir will be so far advanced by next summer as to admit of the compensation water to millowners being stored therein, and the water sent down to Cardiff; the whole of the pipe line, with balancing reservoirs, &c. *en route*, being complete and in working order.

In the Taff Fawr Valley the Corporation have one of the finest watersheds in the kingdom, with an almost inexhaustible supply of pure soft water, eminently suitable for all domestic and manufacturing purposes.

Since the Corporation have had the water supply in their own hands there has been a full and *constant* service to all parts of the district, excepting for a short time in the summer of 1887, when the water was turned off for a few hours in each day so that the available water in store should be conserved as far as possible for any contingencies which might arise.

The total cost of the waterworks undertaking to the Corporation has been over 800,000*l.*, and the annual revenue from all sources has increased from 18,000*l.* in 1880 to 35,000*l.* in 1890.

The effect produced on the public health of the district by the various public works which have been constructed may be seen in the

reduction of the death-rate which has taken place during the past 40 years.

The average annual death-rate, which in the 10 years ending 1854 was 327, was reduced in the 10 years ending 1889 to 197 per 10,000 of the population, and the death-rate from the chief infectious diseases was reduced from 98 to 31 per 10,000 during the same period. A most marked reduction has taken place in the death-rate from typhoid fever, which fell from 19 per 10,000 in the 10 years ending 1854 to 3 per 10,000 in the 10 years ending 1889.

The streets of the town are wide, well kept, and exceedingly well lighted. The main business thoroughfares, known as St. Mary Street and Queen Street, are unusually wide for a provincial town, and the lighting of those thoroughfares is not surpassed in any provincial town in England.

The total length of highways in the borough is now 81 miles; while in 1875, including the districts then annexed to the borough, the total length of highways was only 32 miles. The carriage ways are mostly macadamised, and the footways are well flagged with local flagging, which is of excellent quality. About seven miles of street tramways, the property of private companies, traverse the main thoroughfares.

In 1875 a Bill was promoted in Parliament for annexing the adjoining districts and for carrying out a number of street improvements and widenings whereby a large number of disreputable cottages were swept away, and some of the most important thoroughfares reconstructed, widened, or improved, about 250,000*l.* being spent in this work.

A further Bill was promoted in Parliament in 1887 whereby power was obtained for constructing a new means of communication between the commercial parts of the town in the neighbourhood of the docks and the districts of Grangetown and Canton, on the western side of the River Taff. These works comprised about a mile of fine roads, a bridge over the River Taff, 464 feet long, and another bridge over the Glamorganshire canal, 104 feet long, the whole work costing about 52,000*l.* The principal feature of these works is the bridge over the River Taff, which, by permission, has been called "Clarence Bridge," in honour of His Royal Highness the Duke of Clarence and Avondale, who performed the opening ceremony September 17, 1890. It consists of a central swinging span of 190 feet 8 inches, providing two openings each of a clear width of 72 feet for the passage of vessels navigating the river, and two end-fixed spans each 132 feet. It is 40 feet wide, and consists of a carriage way, 24 feet wide, and two footways, supported on cantilevers on the outside of the main girders, each 8 feet wide. The main girders are pin-connected trusses with single intersection quadrangular web bracing; those for the fixed spans are of a uniform height of 17 feet, while those for the swinging span are 17 feet high at their extreme ends rising by an upward curve to 25 feet over the central pier. They are braced together overhead, giving a clear

headway for carriage traffic of 16 feet. The whole of the weight of the swinging span, which is upwards of 500 tons, rests entirely upon the central pier, not only when the bridge is swinging but also when closed and ready to receive the road traffic. It is believed that this is the first swing bridge constructed upon this principle in the United Kingdom. It is also believed that up to date it is the largest swinging road bridge erected in the country.

The Corporation some years ago purchased baths from a private company. They consist of swimming, Turkish, and slipper baths, and are still carried on by the Corporation for the benefit and comfort of the public.

Two separate and complete sets of new slaughter-houses, with appliances on the most approved principles, have been erected by the Corporation, one at either side of the town, and upon this department the sum of 18,500*l.* has been expended, exclusive of the cost of the land, and the whole of the slaughtering of the borough is now confined to these premises with the exception of imported foreign cattle which are slaughtered at the docks. There is a cattle market adjoining each of the two public slaughter-houses where most of the cattle, &c., slaughtered in the borough are purchased. Cattle markets are held twice weekly.

The Corporation erected a market hall in the year 1835, but this becoming inadequate for present requirements, besides being badly ventilated and lighted, was last year taken down and a new market erected upon the same site, at a cost of about 17,000*l.*, additional accommodation being provided by means of a gallery running round the main building. A retail fish market has been provided at one end of the site.

The new building is one of the most attractive, handsome, and convenient markets in the kingdom, being provided with all the latest and most approved appliances. This building was opened for public business by the Mayoress of Cardiff, the most honourable the Marchioness of Bute, on the 8th May 1891.

The public authorities have not yet completed any large park or pleasure grounds, but there is every reason to expect that in a few years' time in this respect also Cardiff will be better provided than most towns similar in size and population. For many years the public has had to be content with the pleasure grounds so generously provided and maintained by and at the expense of the present Mayor of Cardiff, the most noble the Marquess of Bute, comprising the Sophia Gardens and "Cardiff Arms" Park, both very centrally situated, and to which the public has free admittance.

Within the past two or three years, however, the Corporation has obtained by gift from Lord Bute ten, and from Lord Tredegar three small open spaces in various parts of the town, varying from a quarter of an acre to about two acres in extent each, and these are now being attended to and considerably improved by the public authorities. The Corporation has recently acquired, by compulsory powers, two pieces of

common land on the western side of the town, the one comprising about 40 acres, and the other 30 acres, and has obtained powers to expend the sum of 10,000*l.* in laying out these lands as public parks and recreation grounds. On the eastern side of the town the Corporation has recently secured by deeds of gift about 125 acres of land for the purpose of a public park or parks and recreation grounds; of this land about 100 acres was contributed by Lord Bute, the remainder being given by Lord Tredegar and by Messrs. Clark and Jackson.

This park is now being laid out at an estimated cost of 54,000*l.*, and when complete it will be unique, and will form one of the most attractive and handsome parks in the provinces.

The land lies in the bottom of a valley, with rising ground on either side; a pellucid brook of no mean dimensions winds through the entire length of the land from end to end, a distance of 1⅔ miles; a handsome road, 40 feet wide, is being formed round the entire site, which will provide a carriage drive of 3¼ miles; and another of the main features in the scheme is the formation of a lake half a mile long, with an average width of 200 yards, for boating and other aquatic purposes.

Up to the present time there has been no proper accommodation for the treatment of infectious diseases, but plans have been prepared upon the pavilion principle by the borough engineer, and approved by the council, for the erection of an infectious diseases hospital suitable to accommodate 50 patients at the present time, but capable of being extended ultimately to accommodate 166 patients, upon a site 12 acres in extent, recently purchased for the purpose at a cost of 1,800*l.*; and application has already been made to the Local Government Board for their sanction to borrow the sum of 25,000*l.*, the estimated cost of erecting and furnishing the first portion of these buildings, in order that the work may proceed at once, and it is hoped and expected that when this institution is completed its operations will result in a still further decrease in the number of deaths arising from zymotic diseases.

In educational matters, Cardiff may fairly claim to rank with the great towns, and so far as Wales is concerned, is acknowledged to be the leader in all that pertains to education.

Efforts are now being made to formulate a system of education of the most complete and efficient character, which, commencing with the elementary schools, shall be continued through the higher grade school, intermediate school, technical school, and culminate in the University College. The elementary education is provided in 19 voluntary and 13 board schools. The higher grade school, opened in 1885, is under the school board, and was the first school of its kind established in Wales. The technical school is a development under the provisions of the Technical Instruction Act, 1889, of the science and art schools established by the Free Library and Museum Committee in 1865. An arrangement has been made with the Council of the University College to provide accommodation and teaching staff. The scheme for intermediate schools under the Welsh Intermediate Education Act, 1889, has just been submitted to the Education Department. As the result of

an inquiry commenced in 1880, on the state of higher education in Wales, the Government agreed to the establishment and endowment of university colleges for North and South Wales respectively. Cardiff was chosen as the site for South Wales after a keen competition with Swansea. The college was opened in 1883, and a day training college for elementary teachers under the new code was added in 1890. The Welsh Intermediate Education Act was passed on the recommendation of the same Committee of Inquiry. By means of scholarships and exhibitions it is hoped that the educational chain between all these institutions will be completed, so that the poorest boy or girl may receive the advantage of a complete course of education.

The free library was established under the Public Libraries Acts in 1862, and the museum in 1867. These two institutions are located in buildings erected in 1881–2, at a cost of 10,000*l.*, to which extensive additions are about to be made at an estimated cost of 16,000*l.* exclusive of the site. The library (lending and reference) contains about 43,000 volumes, including a magnificient collection of books and manuscripts in Welsh or relating to Wales. The museum is mainly natural history, the local geology being well represented. There is the neucleus of a good art gallery (which will be provided when the buildings are extended) in a choice collection of modern paintings of the value of 10,000*l.* presented by one donor, the late William Menelaus, Esq., of Dowlais, and many important paintings have been given by other gentlemen.

The County Borough of Croydon.

Delegates to the Congress.

ALFRED CARPENTER, M.D., J.P.
C. COLEBY MORLAND, J.P.

The county borough of Croydon is about 10 miles from the Royal Exchange, London; it adjoins the metropolis on the south side, and is within the district of the Metropolitan Police.

The town lies in a valley at the head of the River Wandle.

The area of the borough is 9,014 statute acres. The population in 1851 was 20,548, and at the recent census (1891) it was 102,697, having increased at the rate of 30·33 per cent. since 1881.

The residence of the Archbishops of Canterbury formerly adjoined the parish church, but in 1809 an Act of Parliament was passed enabling the Archbishop to alienate the site of the Palace, and in pursuance thereof the Addington Estate was purchased.

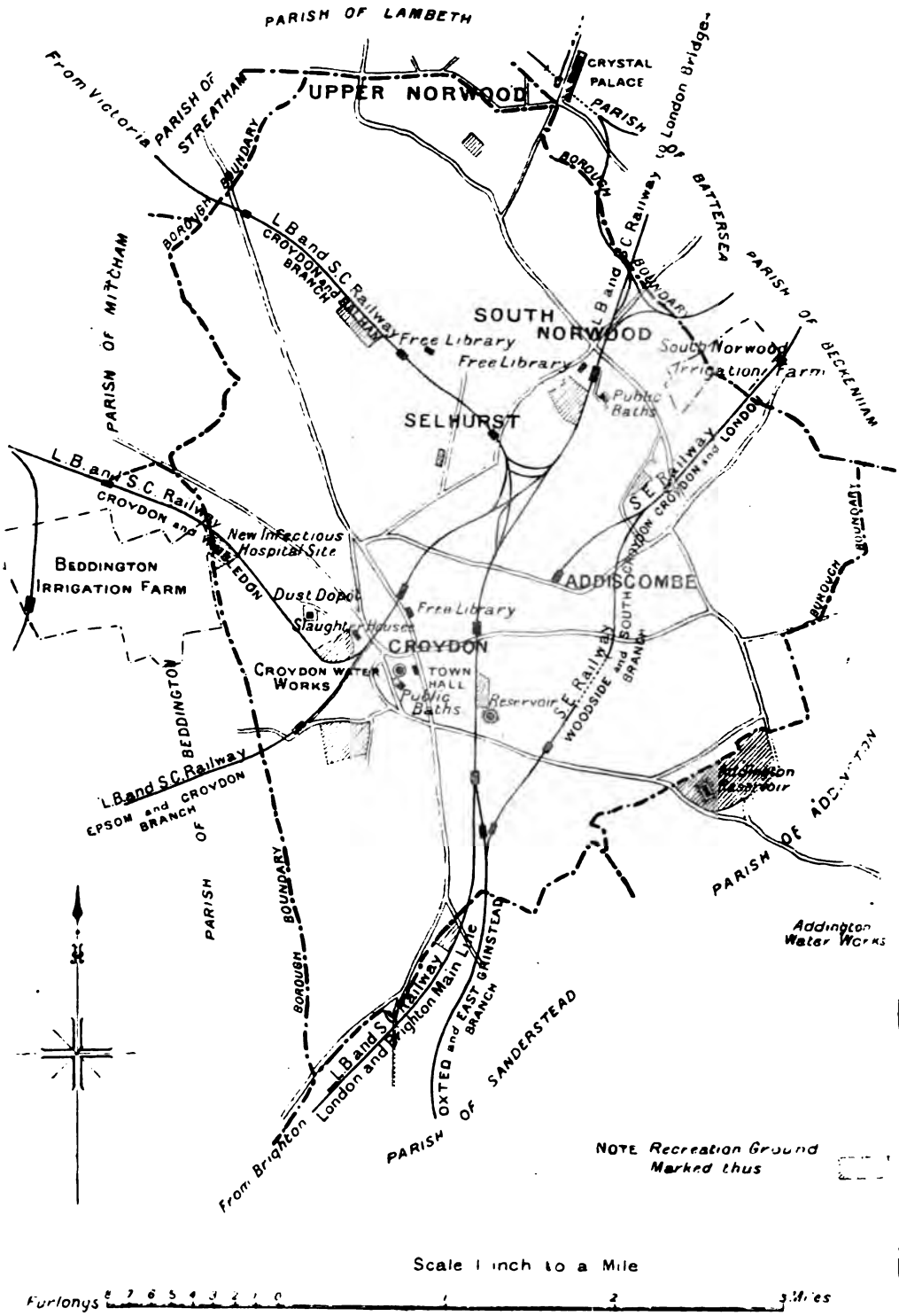
Croydon was one of the 15 towns included in the first Provisional Order for the adoption of the Public Health Act. Prior to the adoption of the Public Health Act a series of ponds and milldams, into which the drainage of the place was discharged, rendered the subsoil very damp, and in consequence the death-rate was very high.

When the Public Health Act was adopted the town was devoid of any system of sewerage, the houses being drained into cesspools, the overflow of which discharged into the watercourses and ponds; and in consequence of the superficial character of the drainage very few of the wells in the town were free from contamination. The state of the courts, lanes, byeways, &c. is described as having been in a deplorable condition and unfit for ordinary traffic.

The Provisional Order for the adoption of the Public Health Act was obtained on the 1st August 1849, and the local board at once commenced to sewer the town and to give it an abundant supply of water. By the end of the year 1867 112,000*l.* had been expended upon drainage, but earthenware drain pipes were then first being introduced and were of inferior quality, and many of the sewers were too small and were without ventilation. In consequence of this a serious outbreak of typhoid fever occurred in the town. The improvement of the sewers was then vigorously taken in hand. A thorough system of ventilation was introduced; many of the sewers were enlarged and extended; the total amount thus spent upon them being 161,967*l.*

There was great difficulty in dealing with the sewage; it was chemically treated in every way then known, but the River Wandle was fouled, and a perpetual injunction was obtained restraining the board from further polluting it. Just at this time the local board obtained power to take land for irrigation purposes outside the borough, which they at once did at Beddington, where they established an irrigation farm, which has been increased from time to time as the quantity of

CROYDON.


PARISH OF LAMBETH
From Victoria
PARISH OF STREATHAM
UPPER NORWOOD
CRYSTAL PALACE
PARISH
BOROUGH
BOUNDARY
L B and S C Railway
CROYDON and PURLEY BRANCH
L B and S C Railway (London Bridge)
PARISH OF BATTERSEA
PARISH OF BECKENHAM
PARISH OF MITCHAM
SOUTH NORWOOD
Free Library
Free Library
South Norwood Irrigation Farm
Public Baths
SELHURST
L B and S C Railway
CROYDON and WALLEDON
New Infectious Hospital Site
BEDDINGTON IRRIGATION FARM
Dust Depot
Slaughter House
Free Library
CROYDON
TOWN HALL
Public Baths
Reservoir
CROYDON WATER WORKS
ADDISCOMBE
S E Railway
CROYDON and LONDON
S E Railway
SOUTH CROYDON and WOODSIDE BRANCH
BOROUGH BOUNDARY
L B and S C Railway
EPSON and CROYDON BRANCH
PARISH OF BEDDINGTON
BOROUGH BOUNDARY
Addington Reservoir
PARISH OF ADDINGTON
Addington Water Works
L B and S C Railway
London and Brighton Main Line
OXTED and EAST GRINSTEAD BRANCH
PARISH OF SANDERSTEAD
From Brighton
NOTE Recreation Ground Marked thus
Scale 1 inch to a Mile
Furlongs 8 7 6 5 4 3 2 1 0 1 2 3 Miles

sewage has necessitated. It now consists of 525 acres of freehold land, 420 of which are under irrigation. The Board also established an irrigation farm at South Norwood, upon which another outfall sewer discharges. There are 79 acres of freehold and 32 acres of leasehold land in use at South Norwood.

Broad or surface irrigation only is adopted; or in other words, the sewage flows slowly over the surface of the land in a thin film amongst the root of rye grass or other crops; these take up the impurities in the sewage, and after a flow of about 500 yards it is bright and clear. The sewage is applied to about three plots in succession before it leaves the farms, when the effluent is found to be bright and well cleansed.

From careful gaugings, the effluent leaving the farms has been found to be about 70 per cent. of the sewage coming on the farms, but this varies with the season of the year. Seven crops of rye grass from the same plot have been cut during a season, but the average is about five crops and there is often a difficulty in getting rid of the produce.

The sewage is purified without cost except for the purchase money or rent of necessary land. This involves a payment of about 4½*d.* in the pound on the rateable value of the districts draining to the farms. This expense will continue for about 35 years longer, by which time the whole purchase money (about 227,712*l.*) will have been paid off.

In 1850 the local board established waterworks by sinking a well in the chalk in the valley of the Wandle, close by the town, which gave an abundant supply of water. Duplicate pumping engines were erected on the site for raising the water into a covered reservoir on Park Hill, 74 feet in diameter and 35 feet deep. Since then two other wells and two larger pumping engines have been placed on the same site, and about two million gallons are now usually pumped every day from it. In 1887 a new well was sunk in the valley south of Addington village, also in the chalk, an engine erected, and the water forced into a covered reservoir erected on the top of Addington Hills at sufficient altitude to supply the whole of the borough; about three-quarter million gallons per day are now supplied from this reservoir. The total amount thus spent on the waterworks up to the present time is 153,963*l.*

Public baths have been erected in Croydon and in South Norwood, both establishments having covered and open swimming baths, private baths, &c., at a cost of 16,341*l.*

The public slaughter-houses, costing 4,232*l.*, are near to the Town hall, and afford ample accommodation. Thirty private slaughter-houses still exist in various parts of the borough.

The length of public highways in the borough is 90 miles. The roads have been much improved by curbing, asphalting, or paving the footpaths, upon which 69,973*l.* have been expended.

The borough being a very large one, it has been thought better to have a number of recreation grounds in various parts of it rather than one or two large ones only. Eleven have been provided with an aggregate area of 204 statute acres, at an expenditure of 48,069*l.* Most

of these have recently been opened, and the burgesses are much pleased with this provision.

The Corporation has just purchased eight acres of land in a suitable position for the erection of an infectious hospital. The land is being fenced in and buildings will shortly be erected.

The Libraries Acts have been adopted in Croydon, and the Corporation have established a central and two branch libraries, and also have opened four evening reading-rooms with small circulating libraries attached, in various parts of the borough The Corporation are, moreover, erecting a Polytechnic building for technical instruction, which is intended to accommodate 320 students at one time.

The ratepayers have recently sanctioned some considerable town improvements, for carrying out which an Act of Parliament has been obtained. They will comprise the abolition of a nest of rookery dwellings, the improvement of the high street of Croydon, and an increase of its width, from about 24 feet in its narrowest portion to a uniform width of 54 feet throughout. In connection with these improvements the old Town hall, which has been in existence since the beginning of this century, has to be demolished, and the Corporation have purchased the site of a former railway station, upon which they are about to erect a block of municipal buildings, courts, and library, the whole involving an expenditure of between 150,000*l.* and 200,000*l.*

As a result of the sanitary measures taken for the improvement of Croydon, the death-rate has been brought to a very low figure, the following being the rates of the last five years:—1886, 14·47; 1887, 14·65; 1888, 13·11; 1889, 13·82; and 1890, 16·61.

The rateable value of the borough to the poor-rate is 583,929*l.* The debt is 557,554*l.* and the capital expenditure on various works has been as follows:—Waterworks, 153,963*l.*; sewers and surface drainage, 150,781*l.*; purchase of land for sewage irrigation (Beddington farm, &c., and South Norwood farm), 227,712*l.*; purchase of land for recreation grounds and laying out, 48,069*l.*; baths (Croydon and South Norwood), 16,341*l.*; slaughter-houses, 4,232*l.*; kerbing and paving, 69,973*l.*; widening bridges, 9,711*l.*; flushing tanks, &c. 11,186*l.*; High Street improvement, 2,580*l.*; purchase of Central Croydon Railway Station and improvement of Park Lane, 11,903*l.*; on account of new municipal buildings, 72*l.*; libraries (Central and South Norwood), 640*l.*; total, 707,163*l.*

Many of the loans contracted for the above expenditure have been paid off.

It may not be uninteresting to note that the rates levied for all purposes in the borough, including poor, police, school board, general district and borough rates, have been in the pound as follows, during the last ten years:—1882, 5*s.* 11*d.*; 1883, 6*s.* 3*d.*; 1884, 6*s.* 4*d.*; 1885, 5*s.* 3*d.*; 1886, 5*s* 5*d.*; 1887, 5*s.* 1*d.*; 1888, 5*s.* 3*d.*; 1889, 5*s.* 1*d.*; 1890, 4*s.* 9*d.*

The City of Dundee.

Delegates to the Congress.

Lord Provost MATHEWSON.
Bailie WM. MCDOUGALL OGILVIE.
Councillor R. D. B. RITCHIE.

The city of Dundee is situated on the north bank of the River Tay in the county of Forfar, and, as in all the ancient royal burghs of Scotland, the inhabitants were formerly huddled together in houses built in narrow closes and pends, and no provision made for street accommodation or even necessary means of ventilation. Large sums have therefore been expended in the public improvements necessary to meet the increased population, and to accommodate the great expanding trade and manufactures of the city. While the area of the ancient royalty was 194 acres, the present area of the city extends to 3,863 acres, to low-water mark. The population in 1821 was 30,575, and at the present time it is 155,433.

By the adoption of the General Police Act of 1850, Dundee entered upon a period of improvement, which has gone on at a progressive rate, and has told favourably upon the health and comfort of the community.

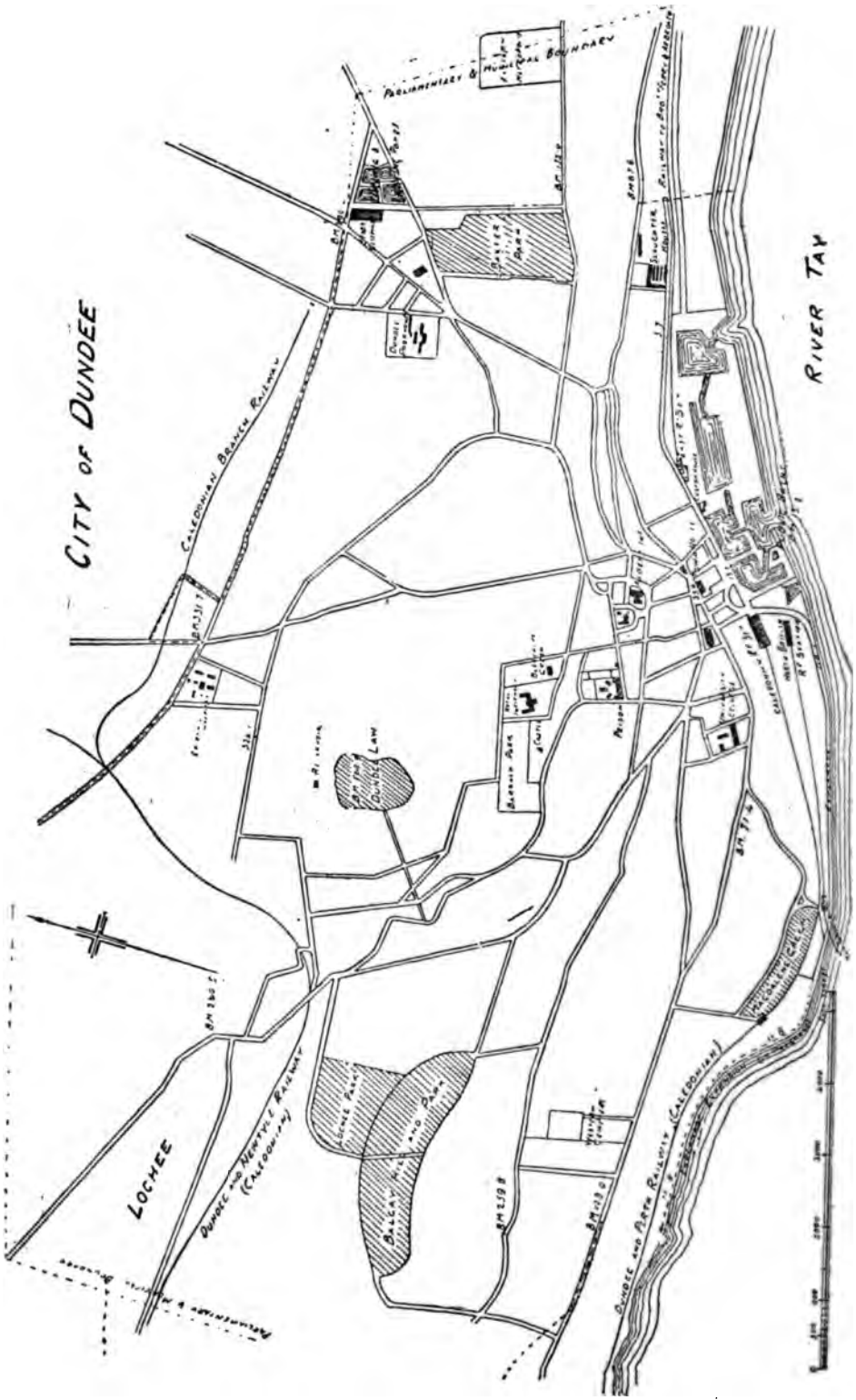
Extensive drainage works were commenced shortly after that date, and from an expenditure in 1857 of 7,912*l.* 11*s.* 5*d.*, it increased to 152,493*l.* 3*s.* by 15th May 1890. Prior to this there was no real drainage in the burgh.

Obnoxious cesspools also existed in various parts, and polluted water was freely discharged on to the surface of the streets, back courts, closes, and passages. At present the main drains are constructed on the most approved principles. The total number of main sewers within the city is 478, and the total length of sewers 66·68 miles.

On account of the ground rising in all directions from the centre of the town near the riverside, the surface water and drainage discharge ran towards the centre, and in order to prevent flooding the Corporation promoted a large intercepting main sewer, running eastwards towards the river, at a cost of 20,000*l.*

The streets in the city, especially in wet weather, were most unserviceable, and even dangerous; the Police Commissioners, under their statutory powers, gave special attention to this matter, and at the present day Dundee is considered to be one of the best paved and flagged cities in the country.

In 1870 a Local Bill was promoted for reconstructing parts of the burgh, for opening up new streets, and executing other necessary works, in order to improve the sanitary condition of the town. The total number of streets and roads is now 527, and their total length is 71·5 miles, and since the passing of the Improvement Act, 1871, no less than 185 new streets have been sanctioned by the Commissioners of Police.


CITY OF DUNDEE
RIVER TAY
LOCHEE
CALEDONIAN BRANCH RAILWAY
DUNDEE AND NEWTYLE RAILWAY (CALEDONIAN)
DUNDEE AND ARBROATH RAILWAY (CALEDONIAN)
DUNDEE LAW
BALGAY HILL AND PARK
BARNHILL PARK
PARLIAMENTARY & MUNICIPAL BOUNDARY

Prior to this time, many of the streets were very narrow, and traffic was carried on with great difficulty and danger in leading thoroughfares. There was much overcrowding in the central, oldest, and most insalubrious parts of the town, which in its turn resulted in immorality, degradation, and crime.

The Improvement Scheme, for which an Act was obtained in 1871, consisted of 20 important works and many valuable provisions for the control of buildings and sanitary requirements. Numerous areas of the town were scheduled, and the clearing of the buildings from these areas resulted not only in the removal of narrow streets and thoroughfares, but of a great number of narrow closes with high buildings on either side, some of which were also covered with houses of the worst kind, and which were styled "Nurseries of disease, immorality, and crime." The demolition and removal of these and other old buildings made way for the new improved and wide streets which have since been constructed, and for the most part built upon to the height of from four to five storeys, the buildings being of substantial and elegant construction and style, giving character and dignity to the city, and, indeed, changing the face of the town.

In the purchase of properties and in the construction of the burgh under the Improvement Scheme, the Commissioners have expended 504,335*l.* 15*s.* 6½*d.*, of which sum a considerable amount remains on loan, to be gradually liquidated from the feuing of the side building ground along the streets.

The spaces thus cleared contained an excess of population, one of them containing a population of 855, or 724 persons per acre, and had a death-rate of 58·4 per 1,000. The rate of population at that time for the whole burgh was 33¾ per acre. Moreover, 1,352 feet of closes, the average width of which was 5½ feet, and of which 328 feet were covered or built over, were demolished.

By these important works, by the operations of the sanitary provisions and powers in the Acts, and by the ventilation and the drainage system, with a most abundant supply of water for sanitary purposes, the death-rate has been much reduced. In 1871 the death-rate was 29·38 per 1,000; in 1889 it was 18·30; and last year, with an epidemic of scarlet fever, it was 21·20. But by the official report of the Registrar-General it is now at 19 per 1,000.

The Corporation, by great efforts, and at an expenditure of 839,544*l.*, have provided an abundant supply of water. They first acquired a supply from reservoirs constructed at Monikie, about 11 miles from Dundee; but by the great increase of population and of trade and manufacture in the City they were obliged largely to supplement the supply, and in 1871 acquired a large source of supply from the Loch of Lintrathen in the Grampians. The Loch extended to an area of 101 acres, with a right of watershed from 30 square miles or 19,000 acres of gathering ground. The Commissioners raised the Loch by 20 feet and increased its area to 405 acres, giving a storage of 1,601,000,000 gallons of water. The water is conveyed to Dundee, a distance of 23 miles, by two lines of cast-iron pipes (27-inch diameter)

now delivering in the place of supply in and around the City of between nine to ten million gallons of water daily.

The abundant water-supply for domestic use and public and sanitary purposes, while enabling the Commissioners to give water for all sanitary purposes, at the same time enables them to assist to a considerable extent the manufacturing industries.

The Police Commissioners have erected and carry on swimming baths and public baths of all kinds for the public, and have expended in this department a sum of 14,096*l.*

A large and beautiful Esplanade has been constructed along the margin of the river from the centre of the city westward, communicating with the Magdalen Green, a place of public resort for healthy recreation. This Esplanade, originally about one mile in extent, is in course of further extension for the accommodation of the public, and fully 60,000*l.* have been expended on these works. Tramways extending to upwards of five miles have also been constructed in the city at a cost of 49,000*l.*

New slaughter-houses and appliances on the most approved principles have been erected, which, with the land and amenities, raise the outlay to a cost of 66,744*l.* 19*s.* 3*d.* In this way the Commissioners were enabled not only to shut up private killing-houses within the burgh (which were then kept in a most insanitary condition), but also to provide most convenient accommodation and appliances for the butcher trade and for the sale of live stock and dead meat.

As to pleasure grounds, considerable expense has been incurred. The ancient Magdalen Green, extending to about 17 acres; Balgay Park, extending to 36 acres; Law Hill, extending to 17 acres, have been supplemented by the gifts—first, by the late Sir David and Misses Baxter, of a park extending to 36 acres, all well ornamented and laid out; of the Fairmuir, the gift of Sir John Ogilvy, extending to 20 acres; and of the Lochee Park, the gift of Messrs. Cox Brothers, extending to 25 acres. These afford full and healthful recreation for the people.

The Commissioners have erected a hospital for the treatment of infectious diseases, suitable for accommodating 40 patients, each having a cubic space of fully 2,000 feet. The cost of these permanent works has been about 22,000*l.* There is space in the grounds for such additional accommodation as may be found necessary; and, on the whole, great time, consideration, and cost have been expended by the Corporation and Public Boards towards the improvement of the city and for the preservation of the public health.

Besides the sanitary and other public improvements thus briefly noticed, extensive facilities have been provided for the mental culture and information of the inhabitants. A large and extensive building was, by the liberality of the merchants and inhabitants, built at a cost, with subsequent additions, of fully 40,000*l.*, and dedicated to the memory of the late lamented Prince Consort, with the view of carrying out his enlightened views for the elevation of the people and their instruction in art and science.

In this Albert Institute are included an extensive free library, containing upwards of 50,000 works on history and all departments of literature and science, and having a reference department as well as one for the lending out of books. It contains also museums and art galleries, largely taken advantage of by the public. Its utility may be evidenced by upwards of 200,000 volumes being taken out yearly by the people. To this spacious institute there have been added last year, and dedicated as a Jubilee gift to Her Majesty the Queen, extensive ranges as picture galleries, the cost of which was also contributed by the voluntary offerings of the public, aided by the Corporation. These extensive buildings now constitute the Victoria and Albert Institute, and contain, besides the library and museums, many valuable works of art, affording the community advantages for the study of arts, science, and literature probably not exceeded in any city of the empire.

The Burgh of Dundee was raised to dignity of a City of the Empire by Royal Charter granted by Her Majesty Queen Victoria on 2nd February 1889.

The District of Ealing, Middlesex.

BY

CHARLES JONES, A.M. Inst. C.E., F.S.I., Engineer and Surveyor to the Board.

The district of Ealing is situated some six miles from the Marble Arch westward, in the valley of the Thames, and lies about one mile northward from that river. It was formerly called Yealing or Zealing, of the hundred of Ousselton, in the county of Middlesex, and was principally known as a favourite residential suburb, where many men whose names have become household words in the history of England resided. Amongst these may be mentioned the Earl of Rochford, the Dukes of Marlborough and Argyll, Sir Francis Dashwood, the Percivals, Lord Brooke, and Lord Manners. John Horne Tooke, and the great political writer of the last century John Oldmixon, were buried here. Sir William Lawrence, the eminent surgeon, died here, and was buried in the old parish churchyard. The great Lord Heathfield dwelt in the village, and at Fordhook, Henry Fielding the novelist, and subsequently Lady Byron. In the drawing-room of Fordhook, "Ada, sole daughter of my home and heart," was married to Lord King, afterwards Earl of Lovelace. The Duke of Kent lived at Castle Bar Park, and the late Home Secretary, the Right Hon. Spencer Horatio Walpole, has been for many years and is still a resident amongst us. Professor Huxley was also born in Ealing.

One speciality was the large private scholastic establishments; the largest private school in England, Great Ealing School, was kept for many years by the Drs. Nicholas. Probably not many private tutors could show a longer list of scholars who became men of note than could the Nicholas family,—amongst others, Sir Henry Lawrence, Bishop Selwyn, Charles Knight, Sir Henry Rawlinson, Cardinal Newman, Captain Marryatt, Lord Truro, and many more.

The district of Ealing consists of about 3,225 acres; the main road from Uxbridge to London passes through it, and is slightly over two miles in length. The 200 feet O.D. contour line runs through the district from east to west, and the ground falls from 200 feet to about 37·0 O.D. at the southern, and 50·0 O.D. at the northern outfall, giving a fall of about 150 feet to each set of sewage works: a fact which has considerable bearing upon its healthiness, and makes it a first class drainage district.

The district of Ealing over which the Board have supervision, is not co-extensive with the parish of Ealing, which includes Brentford, the county town of Middlesex, a county which contains within its boundaries the city of London, the city of Westminster and its palaces, and the fountain head of the government of a large portion of the whole world. Some 30 years since it became apparent that the time had come when steps should be taken towards developing its qualities as a

residential place, and an endeavour was made to induce the town of Brentford to co-operate in the formation of a governing body which should exercise the jurisdiction of the Public Health Act, 1847, and under the powers of that Act bring about a change for the better. At this tim Ealing had a population of about 5,200. It was governed by what was known as a highway board, the members being elected for life. The town of Brentford not being disposed to fall in with the above proposal, and having succeeded in defeating by vote the formation of a local board for the parish, a district was formed under the powers of the Act within the parish of Ealing, and on May 25th, in the year

1863, the first meeting of the Ealing Local Board was held, when they at once instructed their surveyor to prepare a scheme for the drainage of that part of the district which lies south of the Great Western Railway. Land was procured in the southern extremity of the district for the erection of precipitating works, and at an early date contracts were issued for the construction of the necessary lines of sewers and works connected with the same.

In the year 1873, the northern portion of Ealing applied to be taken into the district, and this having been brought about, a scheme for the draining of this portion of Ealing was prepared and carried out, a plot of land in the north-east corner, some 22 acress in extent, being purchased to be formed into a sewage farm.

At the time of the formation of the board in 1863, the roads and streets were in a most unsatisfactory condition. Curbing and channelling were unknown. There was no public gas lighting, and a large number of houses were supplied with water from surface wells. This state of things continued up to the year 1869, when the old highway board was done away with by Act of Parliament, and the local board at once determined to reconstruct the roads and paths. A sum of 10,000*l.* being expended in the course of 12 or 18 months in this work.

It would be impossible in this short space to go into the details of these several works. The entire length of the first contract being somewhat over eight miles, the length of sewer now in use in the district is about 30 miles, exclusive of surface drains. The rateable value of the district in the year 1863 was 18,396*l.*, and when it became known that a sum of 21,500*l.* was to be expended in the construction of tanks and sewers, and the purchase of the land, not a few of those who may be called the old residents of the place looked forward with a feeling of dread, and prophesied that the board and their officer would ruin the village. The 28 years that have passed since that time can best give the answers to the doubts then raised. The rateable value in 1863, was 18,396*l.*, and now in 1891, it has reached 162,029*l.*, or an increase since the first rate was made of 143,633*l.* The rateable increase per head of the population from 1863 will be seen from the following table:—In 1863, 3*l.* 9*s.* 2¾*d.*; 1871, 4*l.* 15*s.* 6*d.*; 1881, 6*l.* 7*s.* 10*d.*; and 1891, 6*l.* 15*s.* 0¼*d.* This table shows that the class of property has in no way deteriorated, the rateable value per head having increased in excess of the rate of increase of population.

Shortly after the formation of the board, the Metropolitan Railway was opened, and exercised a considerable influence in the further development of the district.

Much public attention was directed to the Ealing Sewage Works by those who were interested in the subject, and it may be recorded that Ealing was the first place in the valley of the Thames where a thorough and efficient mode of treatment and purification of sewage was tried; and it is worthy of remark in connexion with this matter that Ealing by its energy in dealing with the subject has had its reward, for while the towns along the banks of the Thames have been engaged year after year in litigation, vexatious inquiries, and the expenditure

of thousands of pounds in fruitless endeavours to carry some grand and imposing scheme into effect, Ealing has gone on its way without litigation, and up to the present moment prosperously, in all sanitary matters.

During the past five years the local board has become the owner of the various public greens and commons in the district, and in the year 1883, they purchased the freehold of the lammas lands (some 30 acres) as recreation grounds for the people, making now rather over 100 acres of open grounds, divided between five different portions of the district, in addition to some 20 acres of ground which is laid out in allotments for the poor. These large open spaces, together with the care taken in all sanitary matters, have doubtless much to do with the exceedingly low death-rate at present recorded. At the time of the formation of the board it was some 18 per 1,000, in the year 1888 it was 10 per 1,000, and the average of the past five years is 11·52 per 1,000, a record probably hardly equalled by any inland town in England with the same number of inhabitants, viz., 24,000.

During the past seven years much has been done in the way of planting, the principal roads and thoroughfares being lined with avenues of trees in order to preserve as much as possible the rural character of the district, and enhance its value as a residential suburb. The district is supplied with water by the Grand Junction Water Company, and with gas by the Brentford Gas Company. It is intended, however, at an early period, to introduce the electric light, a Provisional Order having been obtained for this purpose.

In the year 1884 the board erected public baths, consisting of first class bath, third class, and ladies', together with slipper baths and various conveniences appertaining thereto. During the winter months the large bath is used as a gymnasium, only one bath being retained for the public use. A sum of 10,500*l.* has been expended in connexion with this matter, and the taking is about 900*l.* per annum.

In the year 1884, an isolation hospital was erected, an acre and a half of land having been purchased for that purpose. The scheme provides for three separate blocks, together with the necessary administrative block, laundry, &c. Only one block has been at present erected. In addition to the necessary offices the grounds are laid out as a garden, and arrangements have been made by which, in case of emergency, hospital tents may be erected on a concrete floor, which occupies the site of one of the blocks. The entire cost of these works was 6,500*l.*, including the purchase of the land.

The growth of the neighbourhood having necessitated additional office accommodation, as well as enlarged stable buildings, &c., it was decided to erect the present offices, and at the same time to commemorate Her Majesty's Jubilee by the erection, by public subscription, of the Victoria Hall, and to arrange a building for the free library, so that the whole scheme might be brought within one general design.

At the rear of these buildings are the baths, and at the rear of the baths the stabling with all the necessary departments connected with

municipal work, including carpenters' and painters' shops, forge, cart-sheds, mortuary, &c., &c. The entire outlay upon the public buildings (including free library) amounted to 16,000*l.*, of which 7,000*l.* was received from the sale of the old offices; the Victoria Hall, erected by public contributions, cost 4,500*l.*, and stables and fire station 4,000*l.*; or a total of 24,500*l.*

On the road fronting the stables was erected a fire brigade station, capable of containing three engines, with residence for the permanent engineer, and sleeping rooms for men on night duty.

The whole of these buildings are contiguous, and form a block of altogether some two acres of ground.

During the past four years the whole of the bridges across the Great Western Railway connecting the northern and southern districts have been widened and a new one has been erected.

A feature of great interest has been the destructor and fume cremator, erected in the year 1883, at the southern sewage works. In this destructor not only is house refuse from the district destroyed, but the residuum from the sewage, there being no means of dealing with this for agricultural purposes. The steam power created is used in the works for pumping, electric light, &c.

This work, although in close proximity to houses in the district, is carried out with no inconvenience or nuisance in any way.

The Victoria Hall already referred to was opened by his Royal Highness the Prince of Wales, December 15th, 1888.

The free library (lending department) has some 7,500 volumes, including works in all departments of literature and science, and a reference library of nearly 1,000 volumes. The value set upon the library may be estimated by the fact that in the year 1891, the total circulation was 113,949, and the attendance in the reading rooms nearly a quarter of a million.

In addition there are provided science and art classes, and a large studio used as an art school.

The loan indebtedness of the board is only one-half of the rateable value of the district, and the rate has not exceeded for the last 11 years the sum of 1*s.* 6*d.* in the £ half-yearly, with ½*d.* in the £ for the free library.

The City of Edinburgh.

Delegates to the Congress.

Lord Provost Rt. Hon. JOHN BOYD.
Bailie JAMES ALEXANDER RUSSELL.
HENRY D. LITTLEJOHN, M.D., Medical Officer of Health.

The area of the city within the municipal boundaries is 6,166½ acres. This area includes 1,171 acres of public parks and recreation grounds, consisting of the Queen's Park, the property of the Crown, but open for public use (614 acres), The Meadows (63 acres), Bruntsfield Links (35 acres), Blackford Hill (95 acres), Braid Hills (156 acres), Calton Hill, (23 acres), Princes Street Gardens and Castle Terrace Gardens (38½ acres), Inverleith Park (61 acres), and—closely adjoining—the Arboretum and Royal Botanic Gardens, also Crown property but open for public use (58 acres), Harrison Park (14 acres), Regent Road Gardens (3⅔ acres), and Montgomery Street Gardens (3 acres), besides several small plots used as public bowling greens and children's playgrounds.

In 1871 the population of the city amounted to 197,581, in 1881 to 236,000, and in 1891 to 261,261. The average rate of density of population, exclusive of public parks and recreation grounds, is 52 persons per acre. The maximum rate of density of population is 900 persons per acre, which is to be found in a small area of the Cowgate; this has long been one of the most wretched districts of Edinburgh, but is now rapidly undergoing improvement.

Edinburgh probably has a more difficult problem in the condition and improvement of its "slums" than any other city of its size. This is largely due to the fact that for purposes of mutual protection and defence in warlike times, its inhabitants crowded their habitations closely together so as to be under the protection of the castle and within walls of defence which were erected from time to time. The effect of this is seen in the numerous excessively high tenements or blocks of dwelling-houses in close proximity to each other with only narrow closes between. Formerly inhabited by the better classes, these tenements have become subdivided in modern times into single-roomed houses for the abodes of the very poorest classes, giving rise through overcrowding to insanitary and disease-producing conditions.

In the year 1867 a scheme of city improvement was carried out whereby new streets forming avenues of light and air-space were opened up through some of the worst of these over-congested districts. In order to overtake the congestion of the adjoining or intervening districts which remained unaffected by this scheme of city improvement, powers were obtained in 1879, in the same Act which provided for the compulsory notification of infectious diseases, for dealing summarily with insanitary dwelling-houses. This latter question has been diligently prosecuted by the Public Health Committee of the Town Council

as is shown by the following figures:—(1) Uninhabitable houses dealt with during the last 6 years, 2,163; (2) Houses closed as being uninhabitable, 1,077; (3) Condemned houses improved and reoccupied, 744.

The whole sewerage of Edinburgh is disposed of on the water carriage system. With a few exceptions in the poorer quarters of the city, every dwelling-house is supplied with water, water-closets, and sinks. In the course of the last six years under compulsory orders more than 1,100 water-closets and 635 sinks with water service have been introduced into the poorer class of dwelling-houses. The Public Health Committee is careful in insisting that all such sanitary appliances shall be placed next the outer wall so as to be well lighted and properly ventilated.

The question of providing model housing for the working classes has from time to time during the last 30 to 40 years been taken up and treated in a very practical and satisfactory manner by several prominent citizens, and some admirable schemes of well-planned houses of this class have been provided. Some of these schemes are on the self-contained cottage principle, having separate accesses and small plots of garden ground attached. Others are on the "flat" system with external staircases and balconies leading to the houses, each house having thus a separate door of its own entering from the open air. Housing accommodation of the kinds mentioned has thus been provided for 4,000 to 5,000 persons of the working classes. Housing of a class within the reach of the very poor has not yet been provided, although the question has recently been under the consideration of the Town Council.

The matter of public baths has received the special attention of the Corporation. One establishment of this kind, consisting of one men's and one women's swimming pond, and 48 private baths—12 of which have shower-bath arrangements—has been erected. During the summer months there is a weekly average of 4,000 to 6,000 persons availing themselves of the baths. Steps have been taken for acquiring sites for similar premises in other parts of the city.

Public washing-house and laundry premises for the poorer classes, consisting of 26 tubs, hydros, drying chambers, &c. are in course of being arranged for.

In the more densely occupied districts the Corporation have in several cases acquired the sites of condemned and dilapidated houses, and have formed the same into children's playgrounds with see-saws and seats, which are largely used.

A new method has been adopted in providing public conveniences, which are being placed underground, fitted up with all modern appliances, and placed under the charge of an attendant. Five of these have been, or are being provided, at a cost of 3,000*l*.

With reference to the condition of the drainage arrangements and internal sanitary appliances of dwelling-houses throughout the city generally, the authorities have instituted and maintained for several years a thorough-going investigation, with the object of having every house examined and put into thorough order. This is not intended to

supersede but to assist voluntary effort in the same direction. As in the case of new houses, all such work is certified; the reconstruction of the drainage of existing houses is also certified when properly executed. This work has proceeded for the last eight or nine years at the rate of nearly 1,000 houses per annum, at an estimated cost to the owners of 10,000*l.* to 12,000*l.* In cases of infectious disease, wherever the Medical Officer of Health considers it to be desirable, investigation is made as to the sanitary condition of the house where such disease occurs.

All plans of new houses and buildings and of alterations on existing buildings must receive the sanction of the Dean of Guild Court, which sits weekly for this purpose. As the building proceeds, periodical inspection is made, from the laying of the foundations to the completion of the building, special attention being given to the drainage and sanitary appliances; and on completion a certificate is granted that the whole work has been satisfactorily executed. In order to the better supervision of this work, and as the result of recent experience, further powers have been obtained during the present session of Parliament with reference to a higher standard of width of streets and height of houses, extent of open ground in rear of same, the sub-division of houses, and the enactment of the Code of Building Regulations.

As regards the disposal of its sewage, Edinburgh is fortunate in being near the sea (Firth of Forth), and in having good gradients; its sewage is therefore carried swiftly to the sea, and is discharged at, or slightly beyond, low-water mark. The city is naturally divided into three large drainage districts, with three separate outfalls. With the exception of what is used for irrigation on Craigmillar, Lochend, and Craigentinny Meadows, the sewage of Edinburgh, to the amount of nearly 3,000,000 cubic feet per day, is thus discharged directly into the sea. In view of the enormous trouble and outlay in which many cities and towns are involved in order to get rid of their sewage, Edinburgh may be regarded as fortunate in having such facilities within easy reach.

A large sewerage scheme for the purification of the water of Leith, estimated to cost, along with the acquisition of certain mill-lades, nearly 200,000*l.*, is now being carried out, at the instance of the authorities of Edinburgh and Leith, and of the parishes of Corstorphine, Colinton, St. Cuthbert's, and Currie, and several paper-mill owners. The principal part of the works consists of the construction of a large intercepting sewer, seven miles in length, with the necessary branch drains. It is proposed to intercept all sewage and other offensive matter, which at present discharges into the river; and by means of large compensation reservoirs on the upper reaches of the river, to replenish the same with a reasonable supply of pure water. This is an important sanitary measure, intended at once to purify the river, and to prevent the pollution of the harbour of Leith.

For the last 20 years Edinburgh has possessed a horse tramway system which traverses the leading lines of thoroughfare, and for the last two or three years two separate systems of cable tramways have been at work on the northern slopes, affording a pleasant and convenient means of communication. At the present time the alternative questions

of the Corporation undertaking the management of the horse tramway system, or granting a new lease under new conditions to the Edinburgh Street Tramways Company, who have worked the system for the last 20 years, are under consideration.

During the year 1891 an Electric Lighting Provisional Order was obtained, empowering the Magistrates and Council, under certain prescribed conditions to supply electrical energy for public and private purposes.

Edinburgh enjoyed for many years the unenviable notoriety of being subject to periodical outbursts of fever. These assumed in all cases the epidemic form and entailed a large mortality among the citizens. It was observed that the first to suffer were the Irish, then the poorer Scotch, but ultimately all classes of the community were affected, including among the medical profession the physicians and resident officials of the Royal Infirmary, and, lastly, the medical students, who caught the infection in their dispensary practice. There can be little doubt that one main cause of these repeated outbreaks was the manner of housing of the inhabitants which, copied from the French, consisted of piling tenement above tenement until a large over-crowded population was confined in a limited space, and could only communicate with the outer world by a narrow stair which was aptly described by the late Sir Edwin Chadwick as an upright street. Many of these blocks of buildings contained upwards of 200 inhabitants. When infectious disease of any kind broke out in such circumstances it spread with great rapidity and quickly assumed the epidemic form. The hospital accommodation at the disposal of the authorities being limited, the disease was practically allowed to continue its ravages among the population unchecked, until it gradually wore itself out for want of material. Meanwhile the reputation of Edinburgh as a residential city and as the great educational centre of Scotland suffered. The Corporation in 1863 appointed a medical officer of health, who reported on the sanitary requirements of the city, more especially of its poorer districts, which were the hot-beds of infectious disease. Lord Provost Chambers in 1867 inaugurated a comprehensive scheme, whereby the insanitary areas in the old town were satisfactorily dealt with under a special Act of Parliament. This scheme came to an end in 1889, and during its continuance 600,000*l.* has been expended with the following results as regards the general mortality of the city:—

From 1865 to 1874 the death-rate was 26·26 per 1,000;
from 1875 to 1884 it was 19·94 per 1,000; and
from 1885 to 1890 it was 17·51 per 1,000.

Another step in advance was the adoption by the Corporation in 1879 of a clause in a local Act enforcing the notification of infectious diseases by medical practitioners. This has been loyally carried out by the profession, and thus for the first time the authorities became aware of the amount of preventible disease in the metropolis of Scotland. Up to 1891 upwards of 60,000 intimations were reported; the fees payable to medical men amounting to nearly 7,500*l.* One immediate

benefit of the system of notification was the discovery of the necessity of greatly increased hospital accommodation for these diseases.

The Corporation at an expense of 30,000*l.* have provided a hospital with 250 beds, together with a reception house with 70 beds for infected families. In addition, a convalescent hospital with 30 beds has been established at the seaside in the immediate neighbourhood of the city, for the special benefit of patients recovering from infectious diseases.

Meanwhile the Corporation has continued to deal, not with insanitary areas, but with individual houses throughout the city. This they do with marked success and with little friction, owing to a special plan which has been adopted and which has received the sanction of Parliament. In the first instance reports are obtained from the Medical Officer of Health and from the Borough Surveyor as to the sanitary state of the dwelling; these reports are submitted to the Health Committee of the Town Council, and, after approval, notice is served on the proprietors of the dwelling in question to appear before the Health Committee (as representing the Town Council) and show cause why the recommendations of the sanitary officials should not be carried out. Before this informal court there is a free interchange of opinions, and the citizens are satisfied that their objections have been listened to and their proposals met in a conciliatory spirit. The number of insanitary houses dealt with in this way during the last six years is 1,968, of which number 892 have been closed as uninhabitable, the remainder having been improved and re-occupied or otherwise disposed of.

There are 125 miles of roads or streets in Edinburgh, of which 68 are causewayed, 55 macadamised, and 2 laid with wood. On account chiefly of their durability and resistance to the wear and tear of traffic, whinstone and granite setts have been most extensively used. Wood paving has not found favour hitherto. As in other cities, however, the noise of the stone paved streets is much complained of, and the desire is becoming general for smooth paving. For the paving of footpaths "granolithic" cement is at present more in use than any other, especially for suburban roads.

The cleansing of the city is not the work of private contract, but is performed by the Corporation. The workers or employés in the cleansing department number 390; and 120 horses are employed, with occasional hiring as circumstances may require.

The main features of the cleansing system may be read in the fact that the watercloset is universal throughout the city, and there are ***no ashpits or refuse receptacles of any kind.*** All house refuse is removed daily between the hours of 6 and 8.30 a.m. during the week; and in the poorer districts special provision is made to ensure cleanliness by taking away refuse accumulations on Sunday. The annual collections represent 110,000 tons, 90,000 of which consist of house refuse and street sweepings, the remaining 20,000 tons being mud and road scrapings.

The cleansing of the city costs about 30,000*l.* per annum. This is equivalent to 3½*d.* per £ of the assessable rental, or about 2*s.* 2*d.* per head of the population.

The one great and still growing difficulty in connexion with the cleansing of Edinburgh is the want of suitable outlets for the dry refuse. This difficulty points to the probability of the city being compelled to burn its refuse collections; and the erection of one or more destructors is at present in contemplation.

Through the munificence of private individuals within the last three years Edinburgh has been furnished with a free public library, which cost upwards of 50,000*l.*, the annual expenditure being provided by the rates; a national portrait gallery costing upwards of 50,000*l.*, besides an endowment of 20,000*l.* for future art purchases; and a new academic hall for the University, which will cost 70,000*l.*

The City of Glasgow.

Delegates to the Congress.

Lord Provost The Hon. JOHN MUIR.
Lord Dean of Guild, JOHN URE.
Councillor ROBERT CRAWFORD.
Councillor HUGH STEEL THOMSON.
JAMES BURN RUSSELL, M.D., LL.D., &c., Medical Officer of Health.

The City of Glasgow is the commercial capital of Scotland, in population the second city in Great Britain, and placed by the registered tonnage of its shipping it ranks as a port next to London and Liverpool. It is situated in lat. 55° 51′ 32″ N., and long. 4° 17′ 54″ W., on both banks of the Clyde, 14 miles above the point where that river begins to open out into the Firth.

From the earliest period of its history Glasgow has been a "city" by virtue of being the seat of a bishop. The existing cathedral was founded in 1197, and the university in 1450.

The present area of the city is 6,111 acres, and the population at the census taken on the 5th April 1891 was 565,714. A Municipal Extension Act has been obtained this Session, to take effect on 1st November, which includes 6 police burghs and other populous districts, thus raising the area to 11,861 acres and the population to some 660,000 souls. This gathers together the whole overflow of population since the last great Extension Act of 1846, with the important exceptions of 3 police burghs, the population of which is about 112,000.

The Municipal Government is vested in a town council, 77 in number, of whom 75 are elected by householders. The two *ex-officio* members sit in virtue of their office as "Dean of Guild" of the Merchants House and "Deacon-Convener" of the incorporated trades. The various departments of municipal business are all controlled by the town council either by committees or acting as a whole as trusts constituted by Acts of Parliament for special purposes.

Sanitary History of Glasgow.—Glasgow affords no exception to the rule that the lessons of sanitation are learned in the school of suffering. The only praise due to her is that she has been an apt pupil. Her progress is chiefly recorded in her successive Police Acts, which began in 1800 and close for the present with the "Glasgow Police (Amendment) Act, 1890," which is a purely sanitary measure.

The health of the City was first recognised as a department of municipal duty worthy of the attention of a distinct committee of the Police Board (town council sitting for police purposes) in 1857, by the appointment under the Nuisance Removal (Scotland) Act, passed in the previous year, of a "Committee on Nuisances." One of its first works was to send a deputation through the large towns of England and Scotland to study their sanitary systems. The outcome of their report was the eighth Police Act of 1862, renewed and amended in 1866. A "Sanitary Committee" under the 1862 Act was at once substituted for the Nuisance Committee. The first medical officer of health was appointed in 1863. The first washing and disinfecting establishment was established in 1864. The first epidemic hospital was opened in 1865. The cleansing of the City was taken from contractors and recognised as a department of municipal service in 1868. In 1870 the cleansing and sanitary committees were united under the designation of "Committee on Health," forming a body of 21 members to which henceforth the whole duties of local authority were entrusted. Its first work was to appoint a chief sanitary inspector (an office hitherto held by the chief constable) and to commission him to organise the sanitary administration of the City. Taking the 5 police sub-divisions as his territorial basis, each was treated as a separate sanitary district under a district inspector with an adequate staff of inspectors of nuisances, of epidemics, of lodging-houses, &c., &c., making up a total staff for the city, including clerks, &c. at the headquarters, of 47 persons. Since 1870 the sanitary department has, as regards details, been adapted from time to time to the wants of the City in accordance with the lessons of experience, but it works to this day essentially on the old administrative lines. The greatest advance has been in the material equipment.

The Sanitary Department is administered from the Sanitary Office, 1, Montrose Street, which, besides being on the public telephone system, is connected by private telephone with all the police stations and sub-stations, and with the hospitals and washing-house. The City is for statistical purposes divided into 24 "statistical sub-divisions." These have been grouped into five administrative sub-divisions, as nearly as possible equal in population or sanitary necessity. The vital statistics and administrative statistics of work done are in this way built on one basis.

The Sanitary Staff consists of medical officer of health, chief sanitary inspector, 5 district or superintending inspectors, 16 nuisance inspectors, 9 epidemic inspectors, 5 female inspectors (women who carry on house inspection in the poorer districts to enforce domestic cleanliness); a staff of 5 smoke-testors who apply the smoke-test to the private drains of dwelling-houses, offices, &c. in the City, and especially to all new buildings before occupation. Other departments of sanitary work are carried on without respect to the districts, *e.g.*, night visitation for the prevention of overcrowding. Under the 1862 Police Act all houses consisting of not more than 3 apartments and having an aggregate cubic space not exceeding 2,000 cubic feet may be measured, and the

total contents with the number of inmates allowed at the rate of 1 adult or 2 children under 10 years for every 400 cubic feet (300 until the Police (Amendment) Act of 1890) marked on a tinplate ticket which is affixed to the outer door. All houses so "ticketed" may be visited at night, the inmates counted, and householders, where a number in excess is found, summoned before a magistrate and fined. There are also 4 food and dairy inspectors, 1 inspector of common lodging-houses, and a medical vaccinator who attends at the vaccination hall twice a week. The object is to maintain a large stock of lymph for use in revaccination when small-pox appears.* For statistical and general clerical work there is a large staff of clerks in the office, also a draughtsman.

Epidemic Hospitals.—The estate of Belvidere extending to 32 acres was acquired on the eastern confines of the town in 1870 for hospital purposes. A fever hospital has been erected there containing 390 beds with 2,000 cubit feet of space to each adult; also a small-pox hospital, separate and complete in itself, containing 150 beds. These beds are all arranged in isolated brick pavilions, each containing 30 beds, divided between two wards. The wards are all on the ground floor with open roofs. There are ample grounds laid out for convalescents, with well-grown trees and flower plots. A part of the original fever hospital, built in 1865 of wood on brick basements in the north quarter of the town, is retained as a reserve hospital; it has 120 beds. To meet the necessities of the enlarged City, a site has just been secured in the north-western outskirts, where it is proposed to erect a duplicate of Belvidere. The old reserve hospital will then be abolished.

Washing and Disinfecting Establishment.—This occupies an area of 2,500 square yards of the estate of Belvidere. It is essentially a washing-house fitted up with the best mechanical contrivances, to which infected articles to be treated are driven by a service of vans from all parts of the city, and in the case of the poor returned the same day. It has also a Lyon's disinfector; a cremator for burning straw, chaff, and other material which can only be burned, and a steam carpet-beating machine. On an average 1,000 articles per day are treated.

House Disinfection and Limewashing.—An adequate staff of men is attached to the washing-house to fumigate infected houses with sulphur and to limewash or size-colour the internal surfaces in the poorer class of houses.

The Reception House is a self-contained house with a small piece of exercising ground attached, under the charge of a matron with the necessary servants. It contains 24 beds, and is used to receive the healthy members of families infected with typhus, who generally are very poor and very dirty. They are divested of their clothing and provided with clean suits until it is washed. They are boarded and lodged for from 14 to 17 days, and watched for development of illness; in which case the sick person is at once sent to hospital. In special circumstances this house is used to quarantine people who have been

* In Scotland primary vaccination is carried out under parochial supervision.

exposed to other infectious diseases, but it is useful more particularly in stamping out typhus. Another reception house, with accommodation for 40 persons, has just been acquired, on the opposite, or south, side of the river.

The Infectious Diseases (Notification) Act, 1889, was adopted on 1st January 1890. The following statement shows the current expenditure of the sanitary department under various heads for the year 1st June 1890 to 31st May 1891: hospitals and reception house, 23,364*l.*; disinfection, 2,613*l.*; interest and repayment of principal, &c., 7,991*l.*; miscellaneous charges, 2,033*l.*; general sanitary operations, 9,720*l.*; total, 45,721*l.* During the year, 4,018 patients were treated in the fever hospitals; 338,000 domiciliary visits with reference to nuisances and infectious diseases were made, and 21,000 nuisances and 11,300 cases of infectious disease dealt with; the night inspectors made 45,000 inspections of "ticketed houses"; the female inspectors 47,000 household inspections; about 11,000 apartments were fumigated or limewashed; 561,500 infected articles were washed; 1,000 carpets beaten; 11,600 beds, pillows, &c. were steamed under pressure; 2,000 straw or chaff beds were burned, and fresh material issued.*

The Cleansing Department.—This is conducted by a chief "inspector of cleansing" under a sub-committee of the committee on health. The work of the department embraces (1) the scavenging of all courts and backyards forming a common access to lands and heritages separately occupied. These are mostly attached to tenement houses (dwellings arranged in flats). They are cleaned on a sectional system, each section being divided into beats, to each of which a man is assigned. The courts are thus scavenged once, twice, or even thrice a day, according to locality. (2.) The scavenging and watering of all streets and roads. (3.) The collection, removal, and disposal of all night-soil, general domestic refuse, and detritus. This last is the most difficult, and from a health aspect, the most important section of the cleansing work. The old privy and ashpit system of excrement-disposal is being gradually displaced by the introduction of waterclosets, but is still sufficiently prevalent to require special arrangements. The object is to prepare a manure which will be purchased by farmers. This is done at three refuse despatch works erected (1881–90) in different parts of the City.† Thither the ashpit refuse, night-soil, and street sweepings are carted nightly. The refuse and dry sweepings are screened and sorted in revolving screens. The cinders are sufficient to raise all the steam required to drive the machinery. The rougher rubbish is partly cremated and partly sorted out for economic use, *e.g.*, meat tins for the recovery of the solder; old iron, glass, and anything saleable for sale. The fine ash and dry sweepings are mixed with night-soil to form

* N.B.—All the resources of the sanitary department are placed at the service of the ratepayer without charge incidental to their use. This has been done for many years *ex gratiâ*, but by the Police (Amendment) Act of 1890, the Commissioners bound themselves to do so. Even paupers and prisoners affected with infectious disease are removed from the poorhouses and prisons and treated without charge.

† A fourth is still required to complete the scheme.

manure. The sloppy sweepings are added after draining off the water. The macadamized road sweepings are trucked out to Fulwood Moss, a farm of 125 acres about 10 miles from the City on the Greenock line. When leased 12 years ago it was a useless bog, but it is now reclaimed, and from the road sweepings yields magnificent crops of hay, potatoes, &c. In these various ways the refuse of the City is removed nightly and disposed of by 10 o'clock next morning. Up to 1st June 1891, the capital outlay of the cleansing department for works and plant was 173,000*l.* In the year ending at that date the ordinary expenditure, including interest, was 80,200*l.*; the ordinary revenue was 19,610*l.* The number of men employed was 844: of horses 180. The ashpit refuse, sweepings, &c. removed amounted to 779 tons per working day and 16,263,000 gallons of water were sprinkled over the streets during the year.

City Improvement Trust.—The wynds of Glasgow were a byeword among strangers and a scandal in the eyes of all thoughtful citizens for generations. The evil had grown to such gigantic proportions through long neglect that no common measures could suffice to remove it. One of the first acts of the town council after the extension of 1846 was to set aside 30,000*l.* for the purchase of property in those wynds, and when this sum was exhausted, private philanthropy continued the work. But it soon became evident that some extended, definite, and coherent scheme was necessary, and this was produced in 1865 in the City Improvement Act, the preamble of which sets forth that: "Whereas various portions of the City of Glasgow are so built, "and the buildings thereon are so densely inhabited as to be highly "injurious to the moral and physical walfare of the inhabitants, and "many of the thoroughfares are narrow, circuitous, and inconvenient, "and it would be of public and local advantage if various houses and "buildings were taken down, and those portions of the city recon-"stituted, and new streets were constructed in and through various "parts of the said city, etc."

The improvement scheme embraced about 88 acres, distributed over the old centres of growth of the now continuously built area. On this area a population of 51,294 was housed. The average rate of mortality was 39 per 1,000, and 36 per cent. of all the deaths was caused by epidemic diseases. The Act was passed in 1866 and amended in 1871 and 1880. The magnitude of the operations contemplated is sufficiently shown by the borrowing powers conferred by the 1866 Act to the extent of 1,250,000*l.*, which were raised by the 1880 Act to 1,500,000*l.* The work of demolition began in 1870 and was carried out at intervals until 1877. The first effect of these operations, which coincided with extensive railway clearances, was to stimulate a building "boom." Of the houses in existence in Glasgow in 1881 it is calculated that 28 per cent. had been built within the preceding 10 years. The Improvement Trust were required by their Act to dispose of their ground by public sale. The bidding frequently ran high, and the consequences in some cases were so disastrous to the purchasers that the land came back to the Trust. In 1878 the failure of the City of Glasgow

Bank gave local intensity to the general depression of trade. The Trust was caught not only holding large areas of cleared land, but a large amount of the worst property in the City bought for demolition. There followed, therefore, 10 years of inactivity during which the Trust acted simply as landlords of this property, hove to and waited for a change of wind. This change came two years ago and now demolition and reconstruction are again in progress.

In the earlier history of the Trust the provision of accommodation for the displaced inhabitants was left almost entirely to private enterprise. In addition to the land cleared and laid out or feuing within the scheduled area, the Trust purchased two estates on the southern and western outskirts of the City and feued them, at a cost of 42,000*l.* and 43,000*l.* They built two small "model tenements" at a cost of 3,426*l.* as an example to private builders, but did nothing more for householders. For the lodgers who pervaded the localities which were cleared, living not only in low lodging-houses, but forming a most unwholesome element in the small houses of the poor, they made ample provision in seven "model lodging-houses" erected in various quarters of the City, of which a special account will be found further on. It had been hoped that private enterprise would supply houses suited for the poorer householders, but the cost of the land made that impossible. The Trust was, therefore, compelled to begin to cover its own ground. In Saltmarket they have already erected on the east side tenements in four flats, the street flats being shops, containing 24 houses of one apartment, 58 of two apartments, and 8 of three apartments, and on the west side behind the street building line, a brick tenement of three flats containing 36 houses of one apartment, in each case with all conveniences in the shape of waterclosets, washing-houses, etc. These are fully occupied. But as the rent of the single apartment houses on the street line is 13*s.* 4*d.* per month, and in the brick tenement 12*s.*, it is evident that the poorest householder is still unprovided for. Two efforts are being made to do this; by the Trust in altering the most substantial of the old tenements held by them, putting them under resident caretakers, introducing waterclosets and otherwise making them wholesome and cheap dwellings, and by a private company with a limited dividend. The company has only recently secured its first site, but the Trust, aided by certain extensive railway operations, is rapidly reconstructing and rebuilding. In this way the whole original scheduled area will in a few years be reformed. Supplementary to the Improvement Act of 1866, Street Improvement Acts were obtained in 1873 and 1877, with borrowing powers to 370,000*l.*, which have been all but exhausted in the purchase of property in different parts of the City, and the improvement of streets, etc., etc. The Streets Improvement Committee also hold a considerable amount of poor property with regard to which they are now following the same intelligent policy as the Trust. An interesting result of these circumstances, which are so much of the nature of accidents, is that the ratepayers of Glasgow through their representatives, not only purvey their own water, gas, electricity, and street locomotion, but under the force of circumstances

are becoming holders and purveyors of house accommodation. The Improvement Trust and Streets Improvement Committee own 1,202 houses, of which 551 are one-room and 486 two-room houses. These accommodate 5,300 persons. To these must be added the model lodging-houses with their 2,000 inmates.

Model Lodging-houses.—Between 1871 and 1879 the Improvement Trust erected at a cost of over 87,000*l.* seven model lodging-houses in as many industrial centres of the City. They contain 2,092 beds, for the most part arranged in private compartments with an average of 400 cubic feet of space per bed. One of these houses containing 125 beds is reserved for females. Attached to them are dining halls, reading-rooms, facilities for cooking and washing, and shops for the sale of food stuffs of good quality in small quantities. The males pay 3½*d.* and 4½*d.* per night, the females 3*d.* They are nearly always fully occupied, and yield a net return of fully five per cent. on their original cost. They have acted as "models" in the fullest sense. The old low class houses have been almost extinguished. Private enterprise has established larger lodging-houses which rival the "model" both in size and equipment. The lodgers who used to frequent the small houses of the poor have been to a great extent attracted to these institutions, thereby diminishing the occasion of indecency and immorality, and raising the tone of domestic life.

Public Baths and Wash-houses.—The Police Commissioners erected, between 1878 and 1884, five sets of public baths and wash-houses in the industrial quarters of the City at a cost of 123,500*l.* There are separate swimming ponds for males and females, also private plunge and shower baths. The charge for the ponds is 2*d.* for adults, 1*d.* for boys and girls under 13; for hot plunge baths 4*d.* and 6*d.* The washing-houses are fitted up with every mechanical convenience. For 2*d.* per hour, a woman has a separate washing stall with boiler, washing tub, a compartment in a drying stove, and the use of a hydro-extractor. Those who wish merely to dry clothes washed at home may have a drying compartment at 1*d.* per half-hour. The number of bathers in 1890–91 was about 454,000, the number of washings 155,000. The ordinary expenditure including interest was 12,000*l.*, the ordinary revenue 9,100*l.*

Public Parks, Gardens, and Playgrounds.—The extended City will have over 500 acres of park and garden ground, distributed conveniently to the population of each district within its area, besides a park of 49 acres on the top of a range of hills some distance outside the southern boundary.

Public Markets and Slaughter-houses.—There are no private slaughter-houses in Glasgow. The cattle market, dead meat market, and principal slaughter-house cover together an area of over 11 acres in the eastern part of the City. There are two smaller slaughter-houses in the northern and southern districts. The town council, as local authority under the Contagious Diseases (Animals) Acts, has provided for foreign

animals wharves with lairs and slaughtering sheds on the Clyde at Yorkhill (within the bounds) and at Shieldhall (without the bounds). The former is used for States cattle which must be slaughtered on debarkation, the latter for Canadian cattle, which are removed alive. Each can accommodate 2,000 head at one time. Their joint cost was 62,000*l.* The central fish market is situated near the harbour. "The Bazaar" is the central fruit and vegetable market. The dog and bird market and the old clothes market are illustrations of the public advantage of trades and businesses which tend to fall into the hands of small dealers without capital and become nuisances, being centralized and housed in public premises. This remark applies especially to the old clothes market in Greendyke Street, where lofty and salubrious buildings have been erected at a cost of 20,000*l.* They are leased at a profitable rent to a person of substance who sublets to stallholders and is responsible for their good management. To all interested in the domestic economics of the poor, "Paddies Market" presents a fine field of observation.

Public Provision for Instruction and Amusement.

The Mitchell Library.—In 1874 Mr. Stephen Mitchell bequeathed to the town council as trustees the sum of 67,000*l.* for the institution of a free public library. It was opened in temporary premises in 1877, but is now installed in commodious buildings, 23, Miller Street, purchased from the Water Commissioners and—until the erection of the new municipal buildings in George Square—used at their head offices. They have been entirely reconstructed internally. It contains nearly 90,000 volumes, and is a reading or consulting library only. Several attempts have been made to get the ratepayers to adopt the Free Libraries Act, but hitherto without success, although the number of readers shows the existence of a necessity which a central library cannot satisfy. The available annual income of the Trust is insufficient to adequately maintain this library, and it depends on subventions voted by the town council.

Picture Galleries and Museums.—The Corporation galleries in Sauchiehall Street were erected in 1854 by Mr. Archibald M'Lellan to receive his valuable collection of pictures which he proposed to bequeath to the citizens. He died before his design had been carried out, and the building and collection were purchased by the Corporation in 1856. The collection has been supplemented by gift and purchase, and is rich in specimens both of ancient and modern art.

The Industrial Museum in Kelvingrove Park is a building for the exhibition of the processes and products of the chief industries of the district.

New Art Galleries are about to be built on a portion of the site occupied by the great International Exhibition of 1888, granted by the Corporation. They will ultimately cost 200,000*l.*, the nucleus of which

is the sum of 47,000*l.*, being the surplus of that exhibition. The balance is being raised by private subscription.

The Public Halls belonging to the Corporation are the City hall and the St. Andrew's halls originally erected by a private company at a cost of 62,000*l.*, and recently acquired by the authorities.

Music is provided by the Corporation during the summer in all the parks and in other open spaces in the City. Free concerts are also given during the winter on Saturdays in the halls, which are provided with grand organs.

Water-supply.—The private companies who supplied water to the City were bought up by the Corporation in 1855. The Clyde was abandoned as a source when the Loch Katrine Water was turned on by Her Majesty in October 1859. The Gorbals Waterworks Company obtained their water by gravitation from the hills seven miles to the south of the City. This was continued, and still supplies a large population on the south side of the river. The cost of the new Loch Katrine Works and of the acquisition of the old, including the expenses of the Act of 1855, was 2,100,000*l.* The supply thereby secured was 42 million gallons per day. In 1885 an Act was obtained to extend the Loch Katrine Works at an additional outlay of 1,200,000*l.* which will increase the available supply by 70 million gallons per day, making a possible maximum of 112 million gallons per day. During the year ending 31st May 1891, there was distributed from the Loch Katrine Works 37,192,699 gallons per day, and from the Gorbals Works 4,764,122 gallons, or a total of close on the maximum available until the extension is completed, which will still require two or three years. The population within the area of supply, *which includes extensive suburban districts*, is close upon 840,000 or at the rate of 50 gallons per head per day. Within the City the domestic water-rate per pound of annual value has varied from 1*s.* 4*d.* to 6*d.*, the present rate. Outside the City from 1*s.* 2*d.* to 10*d.* the present rate. There is no charge for baths or waterclosets, and no other restrictions upon the domestic use of the water.

Drainage and Sewerage.—The domestic drains and public sewers of Glasgow are probably as sound and satisfactory as could be desired. No newly built houses or premises are allowed to be occupied or used until the drainage system has been smoke-tested by the Sanitary Department. For many years the house property has been systematically tested in the same way. The occurrence of enteric fever or of diphtheria is always made the occasion of a special examination of drains and soil-pipes. Built drains and cesspools are abolished wherever found. Under the new powers of the Police Amendment Act of 1890 waterclosets are gradually being substituted for privies. There is a complete system of public sewers built on the most approved principles.

All the sewage of Glasgow and its suburbs is discharged into the River Clyde either directly or through its tributaries. The result is that the Clyde is one of the foulest rivers in the kingdom. In the summer,

and especially after long drought, the stench is very great on the river and in its vicinity. The prevailing winds are south-west and west, and bear the effluvia over the whole western districts. It is more than 40 years since the offensive condition of the Clyde began to be talked about. In the interval it has been repeatedly inquired into by local committees and by the foremost engineers. Sir John Hawkshaw reported upon it as a Royal Commissioner in 1876. The chief difficulty has arisen from the number of the polluting authorities, and especially from the number of jurisdictions into which the great central community of Glasgow itself is divided, all of whom must co-operate in any effective sewage scheme. The latter difficulty has in great part been removed by the extension of the boundaries, which takes effect in November, and no doubt the first question to which the enlarged City will apply its united energies is the purification of the Clyde. Meanwhile accident has suggested and given the opportunity for a partial sewage scheme, to carry out which Parliamentary powers have been obtained during the current session. To admit of the construction of an underground railway running below the main streets from east to west, and cutting across the main sewers on their way to the Clyde, it was necessary to intercept and convey the sewage in sections to points of discharge. One of these mains conducts the sewage of about one fourth of the City to Dalmarnock in the east end at a cost to the railway company of between 40,000*l.* and 50,000*l.* The Commissioners have acquired about 30 acres of land there, and have obtained an Act enabling them to borrow 100,000*l.* Plans for sewage precipitation works capable of dealing with 10,000,000 gallons per day are now being matured. Upon the results thus obtained the nature of the measures for the entire purification of the Clyde will depend.

Gas: Electric Lighting: Tramways.—Although not directly hygienic, no statement of what Glasgow has done for itself through its municipal representatives would be complete without noting the fact that gas supply, electric lighting, and tramways are also in the hands of the authorities. Since 1869 gas has been manufactured and sold to the community and suburbs by the Corporation with great financial success. Arrangements are now being made under newly acquired powers to provide electricity also. About the same time the Corporation was successful in opposing a private enterprise to lay down tramway lines in the city, and in obtaining power to own and construct and lease to a private company tramways in the City and suburbs. The first instalment of these lines was opened in 1872. The system now extends to 31½ miles, of which seven are beyond the present boundaries. The lease expires in 1894, and there is every likelihood that the Corporation will then assume the management. Meanwhile the public enjoy an admirable service at a fixed charge of one penny per mile, with a further stipulation that on certain routes, most convenient for the working classes, morning and evening workmen's cars shall be run at half-price. The sanitary advantages of such cheap locomotion in distributing the population over a wider area are obvious.

Sanitary History and Results.

SANITATION.	HEALTH.
1800. First Police Act. 1807. Second do. 1821. Third do. 1830. Fourth do. 1837. Fifth do. 1843. Sixth do. 1846. Seventh Police and Extension Act. „ Scotch Nuisance Removal Act.	1818. Typhus appeared. 1832. Typhus epidemic. „ First cholera epidemic—3,166 deaths: death-rate, 46. 1837. Typhus epidemic — 2,180 deaths: death-rate, 41. 1843. Relapsing fever — 1,398 deaths: death-rate, 32. 1847. Typhus epidemic: death-rate, 53. 1848–9. Second cholera epidemic—3,923 deaths: death-rate, 35. 1853–4. Third cholera epidemic—3,885 deaths: death-rate, 42.
1855. Scotch Registration Act. „ Waterworks Act. 1856. Amended Scotch Nuisance Removal Act. 1858. "Nuisance Committee." 1859. (October) Loch Katrine water turned on.	6 years, 1855–60. Death-rate, chief zymotic diseases, 6·1. Total death-rate, 30·0.
1862. Eighth Police Act. 1863. First medical officer of health. 1864. First municipal disinfection and washing-house. 1865. First municipal fever hospital. 1865. Market and Slaughter Houses Act. 1866. Ninth Police Act. „ Improvements Act. 1867. Public Health (Scotland) Act. 1870. "Committee on Health." „ First sanitary inspector. „ Sanitary department organized. „ Cleansing do. do. „ Estate of Belvidere acquired.	10 years, 1861–70. Death-rate, chief zymotic diseases, 6·5. Total death-rate, 30·4. 1864–5. Last typhus epidemic—2,200 deaths. 1866. Fourth and last cholera epidemic—only 53 deaths.

SANITATION.	HEALTH.
1870–77. Improvement Trust demolitions and reconstructions. 1872. Reception House opened. 1873–77. Streets Improvement Acts passed. 1871–79. Model lodging-houses erected. 1877. Small-pox hospital, Belvidere, opened. 1878. Public Parks Act. 1878–84. Public baths and wash-houses erected.	10 years, 1871–80. Death-rate, chief zymotic diseases, 4·3. Total death-rate, 28·6.
1881. First refuse despatch work opened. 1883. New municipal washing and disinfecting establishment opened at Belvidere. 1884. Second refuse despatch work opened. 1887. Belvidere Fever Hospital completed. 1889. Improvement Trust resumes reconstruction. 1890. Police (Amendment) Act. 1890. Infectious Disease (Notification) Act adopted 1st January. „ Third refuse despatch work opened.	10 years, 1881–90. Death-rate, chief zymotic diseases, 3·1. Total death-rate, 24·4.

The following table gives fuller mortality statistics for each of these periods of sanitary development since registration was instituted in Scotland in 1855. The figures are the annual mean for the period specified :—

—	Mean Population.	Mean Annual Deaths, all Causes.	Typhus and Enteric.		Small-pox.	Scarlet Fever.	Measles.	Hooping Cough.	Diphtheria.
6 years, 1855-60	373,133	11,176	457		232	462	366	618	152
10 „ 1861-70	430,082	13,226	872		100	567	341	647	285
10 „ 1871-80	519,680	14,425	94	215	81	510	365	649	297
10 „ 1881-90	539,588	13,132	25	124	2·6*	264	367	609	287

* 26 deaths in 10 years.

A special word on the influence of the substitution (October 1859) of the pure water from Loch Katrine for the polluted water of the Clyde is necessary. In 1832, 1848, and 1853 there were very fatal outbreaks of cholera. In 1866 the disease was again imported, but it caused only 53 deaths, and has never returned. But the effect on the local diarrhœa was remarkable, as the following table shows:—

—	Mean Diarrhœal Deaths.	Mean Death-rate.	Proportion per cent.	
			Under 5 years.	5 years and upwards.
6 years, 1855–60 -	500	1·34	59·5	40·5
10 „ 1861–70 -	350	0·81	70·0	30·0
10 „ 1871–80 -	410	0·79	75·0	25·0
10 „ 1881–90 -	319	0·59	75·5	24·5

Emphasis must be laid upon the fact that these statistics refer only to the population within the boundaries, beyond which there has been a constant overflow of the cream of the inhabitants, leaving still to the parent city the burden of those classes who always keep close to the heart of cities. The following statement of the proportion of the inhabitants occupying houses of various sizes, as ascertained at the last three enumerations of the people, shows (1) the diminishing proportion of those who dwell in houses of five apartments and upwards; (2) the diminishing proportion of those who dwell in houses of one room; (3) the gradual increase in the proportion of those who dwell in houses of two, three, and four rooms. While, therefore, the "Glasgow," to which these statistics refer, is probably a larger collection of dwellers in small houses than exists anywhere else, the standard of house accommodation has been steadily raised.

Proportion of Inhabitants of Glasgow living in Houses of various Sizes.

—	1861.	1871.	1881.	1891.
1 room - - -	27·0	30·4	24·7	18·0
2 rooms - - -	40·7	41·5	44·7	47·5
3 „ - - -	14·0	13·2	16·0	19·7
4 „ - - -	7·4	5·8	6·1	7·2
5 „ and upwards -	10·9	9·1	8·5	7·6

The City of Gloucester.

Delegates to the Congress.

JOSEPH J. SEEKINGS, Mayor.
A. M. SYDNEY TURNER, M.R.C.S., Chairman Sanitary Committee.
JOHN CAMPBELL, M.D., Medical Officer of Health.
RICHARD READ, A.M.I.C.E., City Surveyor.

The city of Gloucester, situated on the east bank of the River Severn, was garrisoned and fortified by the Romans about A.D. 43, and formed one of their most important stations in the West of England. The centre of the city is on high ground sloping towards the river on the west and south, and rising on the north and east. Of the many Royal Charters granted to the city the earliest now in the possession of the Corporation is that of King Henry II. (about 1160), granting to the burgesses the same customs and liberties throughout all his land of toll and of all other things as the better citizens of London and those of Winchester had at anytime in the time of King Henry, his grandfather. King Richard III., by Charter dated 2nd September 1483, incorporated the town and made it a county of itself, provided for the election of a mayor and sheriffs, and authorised the carrying of a sword before the mayor, and of a mace before the mayor and sheriffs. King Henry VIII., by Charter dated 3rd September 1541, founded the Bishoprick of Gloucester and made Gloucester a city. King Charles II. granted to the city a very lengthy Charter, dated 8th April 1672, embodying the privileges granted by earlier Charters, and this remained the ruling Charter of the city until the passing of the Municipal Corporations Act, 1835. The boundaries of the city were extended in 1848, and again in 1874; and the city now has an area of 1,666 acres, and a population of 40,022, the latter having increased from 36,521 since 1881.

The old city was sewered in 1855 at a cost of 16,000*l.*, and the added districts in 1875–6 at a cost of 15,000*l.* In 1885 some old sewers in the added districts were abolished, and the sewerage of the city was generally improved and ventilated at a cost of about 7,000*l.*

Gloucester has for centuries been supplied with water from reservoirs at Robin's Wood Hill, about two miles from the city. Under the Gloucester Waterworks Act, 1885, these works were purchased by the Council for 18,000*l.*, and new works were constructed at Witcombe, on an escarpment of the Cotswold Hills, about five miles from the city, at a cost of about 100,000*l.*; further schemes for an additional supply are now under consideration.

The Council own a large and very important cattle market, a general market, corn exchange, and the quay on the bank of the river Severn, which together bring in a revenue of about 1,400*l.* per annum, in addition to the rents arising from the lands and other property of the Corporation, amounting to about 3,000*l.* a year.

Gloucester is the most inland port in the kingdom. The Gloucester Docks, which belong to the Sharpness New Docks and Gloucester and Birmingham Navigation Company, are connected with the River Severn at Gloucester and at Sharpness by a ship canal, 16 miles in length, free from locks, except at each end, and capable of passing ships of nearly 1,000 tons (registered) burden.

The Park and Spa pleasure grounds contain an area of about 21 acres, and the Spa has long been noted for its valuable wells of saline and chalybeate waters, which are highly prized for their medicinal qualities.

The county museum and the schools of science and art constitute the chief centre for art, scientific and technical instruction, both for the county and city of Gloucester.

The principal schools of the city are, for boys, the Crypt Grammar School, the Kings or College Schools, Sir Thomas Rich's Schools, and the County School at Hempsted, near Gloucester; for girls, the Endowed School, and the County School at the Spa. There is also a Theological College in connection with the Cathedral.

The Gloucester General Infirmary, the Children's Hospital, and the Dispensary, are large and important institutions.

New public baths of a very complete character, including Turkish baths, two large swimming baths, and first and second-class private baths for both sexes, have just been provided and opened, at a cost of about 12,000*l.*

New municipal buildings are now being completed, at a cost of about 25,000*l.*

During the last 15 years many public improvements have been carried out, and the sanitary condition of the city is, generally speaking, very good. The death-rate, which in 1875 was 24·6 per 1,000, has been steadily reduced, and in 1890 was only 15·2. The zymotic death rate has been reduced from 3·5 per 1,000 in 1875, to 1·5 in 1890.

The County Borough of Hanley.

Delegates to the Congress.

Councillor M. HUNTBACH, Mayor.
Major H. PALMER.
Alderman E. J. HAMMERSLEY.
JOHN CLARE, L.R.C.S. (Ed.), L.S.A. (Lond.), Medical Officer of Health.
JOSEPH LOBLEY, M. Inst. C.E., Borough Surveyor.

The county borough of Hanley is situate in the northern part of the county of Stafford on the north bank of the River Trent, and is about 147 miles distant from London. The county borough is immediately surrounded by four municipal boroughs and a local board district; it contains the largest population of the pottery towns, of which it is the most central and important, and is styled "the metropolis of the potteries." A hundred years ago Hanley presented only a humble collection of dwellings chiefly confined to two small villages half a mile apart. In 1801 it contained a population of 7,940 inhabitants; in 1821, 12,956; in 1841, 20,781; in 1861, 33,009; in 1871, 41,976; in 1881, 48,361; and at the last census in 1891, 54,846. The Borough has an area of 1,768 acres, and was incorporated in the year 1857; prior to which, from the year 1825, it was watched and lighted under a local Act of Parliament which appointed Commissioners and empowered those Commissioners to appoint a chief bailiff who was to be sworn as a constable, also a head and deputy constable and watchman for the preservation of the peace in the town. The Act further empowered the Commissioners to light the streets and to levy rates. Hanley, in addition to being a municipal borough, is also, with the adjoining borough of Burslem, a parliamentary borough, and was formed into a county borough by the Local Government Act of 1888. It is a market town, and situate within the parish of Stoke-upon-Trent, the hundred of North Pirehill, the deanery of Newcastle and Stone, the archdeaconry of Stafford, and the diocese of Lichfield; and has a separate Commission of the Peace and Court of Quarter Sessions, as well as its own Police force.

The chief productions of the borough are earthenware and china, some of the largest manufactories in the district being established in the town. Coal and iron are also extensively produced within the municipal boundary. The history of Hanley is almost confined to its rapid rise and development which is owing to its being the chief seat of the china and earthenware manufacture, for it formerly ranked only as one of the numerous villages of the potteries district. From its topographical situation on the summit and sides of a considerable elevation it is, for a manufacturing town, very healthy.

Extensive drainage works have been carried out at a cost of 70,000*l.*, the sewage being treated by precipitation in tanks followed by filtration through land. Extensive parks are about to be provided; and

the sanction to purchase 105 acres as a site for one of these has lately been obtained from the Local Government Board.

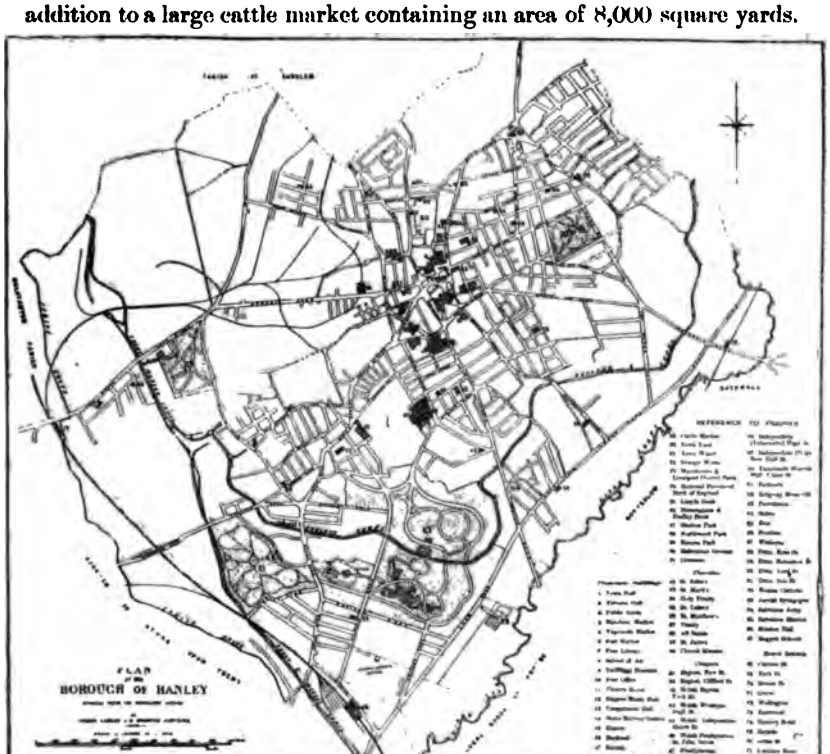
A recreation ground has been in existence for many years; a school of art was formed more than 30 years ago, and it now accommodates 200 students. A Mechanics' Institution, opened in 1861, has been connected with the Free Library which was provided under the Public Libraries Acts in April 1887; and a large and comprehensive Museum has lately been established.

The Town Hall, which was purchased a few years ago, and to which has been added quarter and petty sessions courts, and a large hall which accommodates about 3,000 persons seated, altogether cost 26,750*l.* Public swimming baths, Turkish and other baths have also been provided by the Corporation at an outlay of 10,000*l.*

Public abattoirs on the most approved principles have been erected in the borough, and the water-carriage system of night soil has been adopted.

The gas and water supplies are in the hands of private companies. A hospital for the treatment of infectious diseases has been erected by the council of the borough, in connexion with the adjoining towns of Stoke and Fenton, under the title of the Hanley, Stoke, and Fenton Joint Hospital at a cost of 7,525*l.*, and the cost of patients sent thither from Hanley is defrayed by the Corporation.

Hanley possesses three large covered markets (vegetable, fish, and butchers'), the largest of which is 126 feet long by 120 feet broad, in addition to a large cattle market containing an area of 8,000 square yards.



The County Borough of Huddersfield.

Delegates to the Congress.

Health Committee.	Sanitary Committee.
Councillor Jessop.	Alderman Hirst.
Councillor Brierley.	Councillor Jordan.
	R. S. Dugdale, C.E., Borough Surveyor.

Dr. J. R. Kaye, Medical Officer of Health.

The town of Huddersfield is situate in the West Riding of Yorkshire, 15 miles south of Bradford, and 16½ miles from Leeds. It stands on the slope of a hillside, at heights varying from 250 to 500 feet above sea level. The houses are nearly all built of stone, which abounds in the district, and the new streets are wide, airy, and spacious; but in the older parts of the town they are narrow. Great improvement has been effected by paving the streets with setts.

Two streams, the Colne and Holme, both in a filthy state of pollution, enter the borough separately, and join in the Lockwood district. They occupy the Valley of the Colne, and run first in an easterly direction, and then to the north to join the River Calder just outside the borough.

Huddersfield is considered one of the centres of the fancy woollen trade. Silk and cotton spinning is also carried on. Huddersfield is justly proud of its cleanliness as a manufacturing town, but a great improvement would be accomplished if manufacturers would employ better means for the consumption of smoke.

In 1837 Huddersfield was constituted a parliamentary borough, and the charter of incorporation was granted in July 1868.

The municipal and parliamentary boundaries of the borough are not co-extensive. The limits of the borough comprises the townships of Huddersfield (Central Huddersfield, Marsh, Fartown, Deighton, and Bradley), Dalton, Almondbury, Lockwood, and Lindley-cum-Quarmby. The incorporated area contains 10,518 acres, and the density of population, according to the Registrar-General's estimate, is nine persons per acre; in other words, if the population was evenly distributed over the whole borough, there would be nine persons living upon each acre of ground. This statement is, however, misleading, for whilst some parts of the borough are more sparsely or scarcely at all built upon, others like the central are almost entirely covered with buildings. In the month of November, 1890, the district of Longwood, containing an area of 1,270 acres, and a population of 5,406, with a rateable value of 17,486*l.*, was annexed, but this district has not been taken into consideration in the statistics of 1890.

The subjoined table shows the population and rateable value of the municipal borough for the two decennial periods, and at the present time, viz. :—

Year.	Population.	Rateable Value.
		£
1871 - - - - -	72,253	227,961
1881 - - - - -	81,841	285,847
1890 - - - - -	94,253	362,504

The Public Health Act, 1875, is applicable to the borough, and the Corporation, by the council, is the urban sanitary authority of the district of the borough under that Act.

The following local Acts are now in force within the borough, and show the progress of administration :—Huddersfield Burial Ground Act, 1852; Huddersfield Burial Ground Amendment Act, 1855; Huddersfield Gas Act, 1861; Huddersfield Water Act, 1869; Local Government Supplemental Act, 1869; Huddersfield Waterworks Act, 1871; Huddersfield Improvement Act, 1871; Huddersfield Waterworks and Improvement Act, 1876; Huddersfield Improvement Act, 1880; Huddersfield Corporation Act, 1882.

The following undertakings and works (in addition to the Town Hall), have been acquired or instituted, and are now the property, and under the control of the Corporation :—

1. *Waterworks.*—In 1869 the Corporation acquired the Waterworks Undertaking of the Huddersfield Waterworks Commissioners. The limits of the supply have been extended by the Huddersfield Water Act, 1869, the Huddersfield Waterworks and Improvement Act, 1876, and the Huddersfield Corporation Act, 1880. The waterworks derive their supply from three sources, namely :—

I. The Longwood Reservoirs, capable of storing 70 million gallons of water; II. The Blackmoorfoot and Deerhill Reservoirs, capable of storing 860 million gallons of water; III. Wessenden Reservoirs, capable of storing 189 million gallons of water. The total area of the present limits of supply is 39,758 acres. The capital expenditure to March 31st, 1891, amounted to 913,480*l.* The annual revenue was 48,494*l.* and the annual expenditure 47,682*l.* The water rights of the Wessenden Commissioners have just been purchased at a cost of 50,000*l.* This additional supply of pure water cannot be too highly estimated.

2. *Gasworks.*—The capital expenditure to March 31st, 1891, amounted to 271,126*l.*; the annual revenue to 74,677*l.*, and expenditure to 67,726*l.* The charges for supply to consumers are (*a*) for lighting purposes, 2*s.* 9*d.* per 1,000 cubic feet, and (*b*) for heating, motive power, and cooking purposes, 2*s.* per 1,000 cubic feet, with a discount of 5 per cent. when paid within a specified time.

3. *Markets.*—On the incorporation of the borough in 1868, the powers exercised by the Commissioners in respect of the markets and fairs were transferred to the Corporation. By the Huddersfield Waterworks and Improvement Act, 1876, the purchase of the markets,

fairs, tolls, and market rights, with certain land sufficient to build a covered market and slaughter-house, at a cost of 38,402*l.*, was confirmed, and full powers were vested in the Corporation to erect and maintain markets and fairs, slaughter-houses, and other works in the borough. In pursuance of the powers granted to them by the last-named Act, the Corporation have constructed a large covered market, and have also constructed a cattle market and slaughter-houses. There are only 17 licensed private slaughter-houses in the borough. The total capital expenditure upon markets up to March 31st, 1891, amounted to the sum of 100,653*l.*, and the expenditure upon the public abattoir to 15,248*l.* The income for the year ending February 1891, was 8,031*l.*, and the expenditure for the same period (including sinking fund and interest to provide for repayment of loans), 7,914*l.*

4. *Cemetery.*—By the Huddersfield Burial Ground Act, 1852, powers were given to the Huddersfield Improvement Commissioners to provide a burial ground for the township of Huddersfield; and by the Huddersfield Improvement Act, 1871, the burial ground provided under the Act of 1852 was transferred to and vested in the Corporation. The cemetery now covers 15 acres of land. The amount of capital expended amounts to the sum of 18,069*l.* The income for the year ended March 31st, 1891, was 1,805*l.*, and the expenditure 1,383*l.*

5. *Tramways.*—By their Improvement Act of 1880, the Corporation obtained powers to construct tramways within the borough, and by the Huddersfield Corporation Act, 1882, these powers were extended and enlarged. By the same Acts power was vested in the Corporation (subject to licence from the Board of Trade) to work the tramways themselves. The total length of tramways constructed by the Corporation and now open for traffic is 12 miles, and extensions are in active progress. The capital expended upon the undertaking amounts to the sum of 89,729*l.* The income for the year ended March 31st, 1891, amounted to the sum of 17,911*l.*; and the expenditure, including making provision for sinking fund, depreciation, and all contingencies, to the sum of 19,520*l.*

6. *Public Parks.*—The Corporation have established two public parks in the borough, namely, "Greenhead" Park and "Beaumont" Park. Greenhead Park is situate in the central district, and contains an area of about 36 acres. Beaumont Park is situate in the Lockwood district, and is distant about 1½ miles from the centre of the town; the area of this park comprises about 25 acres. The capital expenditure in respect of these parks amounted, up to March 31st, 1891, to the sum of 104,199*l.*

7. *Sanitary Depôt.*—The Corporation possess a depôt at Hillhouse in connection with the scavenging of the streets and the collection and disposal of night soil, house refuse, &c., and for the work of the Sanitary Department. The capital expenditure on this account so far is 10,462*l.*, and is a charge on the borough fund.

8. *Sewage Construction and Works.*—Under the powers of the Public Health Act, 1875, and the Huddersfield Improvement Act, 1871, the Corporation have constructed large main intercepting sewers for the

main drainage of the borough. Up to 31st March 1891, the capital expenditure on the same has been 41,447*l.*, and further extensions of the sewers are still proceeding.

Sewage Distribution.—Under powers contained in the last-named Act, the Corporation have purchased about 40 acres of land at Deighton adjoining, the capital expenditure, including purchase of land, amounting to 14,096*l.*; and they have commenced the construction of works thereon for the purification, by precipitation, and disposal of the whole of the sewage of the borough. The contract for these works has been let at the sum of 40,196*l.*

9. *Public Baths.*—In 1888 the central wards of the borough acquired the public baths, situate in Ramsden Street, by purchase from a company. The institution comprises all necessary baths and appliances with caretaker's quarters. In addition to the above, public baths are also provided at Lockwood, and are a charge upon that district. A capital expenditure of 6,278*l.* has been incurred up to 31st March 1891. In connection with these baths there is in each case a small deficiency on the revenue account, which is provided for out of the rate in each district.

10. *Hospital for Infectious Diseases.*—A hospital for infectious diseases has been provided by the Corporation under the authority of the Huddersfield Waterworks and Improvement Act, 1876. The present hospital is situate at Birkby on an area of 1½ acres, and is capable of accommodating 72 patients. The Corporation have purchased an additional site of 12 acres, situate at Mill Hill. The total expenditure upon this account up to 31st March 1891 was 7,220*l.*, and is a borough charge. The Corporation obtained powers in their Improvement Acts for the compulsory notification of infectious diseases, and this has proved a most valuable aid in dealing with the suppression and prevention of epidemics.

11. *Model Lodging-house.*—The Model lodging-house for labouring classes was provided by the Huddersfield Improvement Commissioners prior to the incorporation of the borough, under the Labouring Classes Lodging House Act, 1851, and has departments for males, females, and married couples, and a mechanics' home. This establishment has proved itself to be a most useful institution, contributing in no small degree towards the prevention of overcrowding in the common lodging-houses within the borough. The building was extended in the year 1878. The total capital expenditure to the present time is 6,492*l.* The income from this institution, after providing for interest and sinking funds, exceeds the expenditure, and this excess is placed to the credit of the borough fund. The expenditure for the year ended 31st March amounted to 1,072*l.*; but 214*l.* was included for re-drainage and the replacing of the abominable long Hopper closet by the modern water-closets. The income was 979*l.*

12.—*Artizans' Dwellings.*—In the year 1882–3 the Corporation erected 160 dwellings for the labouring classes, under the powers of the Huddersfield Waterworks and Improvement Act, 1876, and the capital expenditure so far amounts to 28,945*l.* These have proved to be of

very great benefit to the working classes in the borough. Since their erection they have been constantly occupied, and this fact leads the council to believe that the dwellings are of a kind which was very much required within the borough. The income for the year 1890 was 1,905*l.* 11*s.* 7*d.*, while the expenditure was only 673*l.* 13*s.* 5*d.* This is an encouragement to extend such dwellings, which are urgently required, because there still exists a fairly large number of cellar dwellings now occupied, although unfit for habitation, and to close them would simply mean overcrowding elsewhere.

If we take the gross annual death-rate as an index of sanitary administration, there has been much improvement. The following was the average death-rate for three periods of five years each:—1876 to 1880, 22·51 per thousand; 1881 to 1885, 20·71 per thousand; and 1886 to 1890, 19·72 per thousand inhabitants. For the three years before and after incorporation in 1868, the death-rate averaged 23 per 1,000 of the population. The population taken at the last census was 94,253, or nearly 5,000 below the population estimated by the Registrar-General.

The Borough of Lancaster.

Delegates to the Congress.

Alderman WILLIAM TOWERS, Chairman Sanitary Committee.
Councillor WILLIAM GILCHRIST, Chairman Insanitary Dwellings Committee.
WILLIAM OLIVER ROPER, Deputy Town Clerk.

The borough of Lancaster stands on the River Lune, about 5 miles from the junction of that stream with the waters of Morecambe Bay. Roman remains are found in profusion in many parts of the town, but owing to incursions of the Scots, the Wars of the Roses, and the Civil War, little beyond the Castle and Church remain to show the antiquity of the buildings within the boundaries of the borough.

So far back as the thirteenth century the Corporation of Lancaster obtained certain tolls to enable them to pave the town through which ran the great western road to the north. In 1824 a body of Police Commissioners were formed to superintend the watching of the town. It was not, however, until the application of the Public Health Act to the borough that any attempt was made to grapple with its sanitary requirements. In 1852 statutory powers were obtained, and shortly afterwards an extensive scheme of drainage was carried out at a cost of over 10,000*l.* This scheme has been extended from time to time, but the cost of all such extensions has, to a great extent, been defrayed from the rates of the year.

About the year 1852 was initiated the system of water supply which has been of so great advantage to Lancaster and its neighbourhood. The supply is obtained from the Wyresdale Fells, where the springs are tapped before the water rises to the surface, and the water conveyed by pot pipes along the Fells, and by iron pipes along the high roads to the town. The amount of water to be taken was limited by the Act of 1852 to 300,000 gallons, and a compensation reservoir was constructed for the benefit of millowners on the River Wyre to contain 28,500,000 gallons. In 1864 authority was obtained for an additional 400,000 gallons per day; the pipes were extended along the Fells, and the compensation reservoir enlarged so as to contain 76,500,000 gallons.

In 1876 further powers were obtained extending the daily supply to 2,000,000 gallons. A new line of pipes was laid on the Fells and continued to a point on the Tarnbrook Wyre 1,433 feet above the sea level. The compensation reservoir was also enlarged so as to contain 185,000,000 gallons, covering about 60 acres of ground. Under the same Act a storage reservoir was constructed which will hold 30,000,000 gallons, and will be available in dry weather to supplement the supply from the springs. This system of water supply cost about 125,000*l.*, of which nearly one third has been redeemed by the operation

of the sinking funds. The water is unusually soft, having less than one degree of hardness, and supplies a district of some 50,000 inhabitants. In 1863 swimming and other baths were presented to the town. These have been since carried on by the Corporation, and are about to be considerably enlarged.

In 1887 the moor above the town was laid out as a public park by the munificence of a Lancaster manufacturer, by whom and by whose son it was liberally endowed. The views from several points in the park include the majority of the mountains in the Lake District, the whole of Morecambe Bay, the flat country of the Fylde, Ingleborough, and the Yorkshire Fells, and in the west the mountains of the Isle of Man.

Large covered markets were constructed between 1876 and 1880 at a cost of 12,000*l.*, and a cattle market at a cost of over 2,000*l.* In their local Act of 1880 the Corporation obtained powers to construct slaughter-houses and to close private slaughter-houses. Accordingly, after the erection of public slaughter-houses at a cost of over 3,000*l.*, the Corporation compulsorily closed all private slaughter-houses in their district.

The Corporation have also erected an infectious diseases hospital suitable for accommodating 20 patients, and have carried out considerable street improvements in the town.

In 1880 the Corporation purchased the gasworks, then in the hands of a private company, at a cost of 87,000*l.* During the last 10 years the price of gas has been reduced to 2*s.* 3*d.* per 1,000 cubic feet, the capital debt has been reduced by over 5,000*l.*, a reserve fund of 6,800*l.* has been created, and large alterations and improvements in the works have been carried out from revenue.

In 1880 also the Corporation obtained compulsory powers for the notification of infectious disease. The experience of 10 years has shown the great value of these powers now so extensively applied in various parts of the country.

In 1889–90 tramways were constructed by a Company to connect various parts of Lancaster with the seaside resort of Morecambe, some four miles distant.

Besides the sanitary and other improvements carried out by the Corporation, extensive provision has been made from other sources for the poor and the afflicted in mind and in body. The County Lunatic Asylum with its 2,000 patients is situate within the borough. The Ripley Hospital was erected 27 years ago for the benefit of orphan children; and just beyond the boundary of the borough is the Royal Albert Asylum for the idiots and imbeciles of the seven northern counties. A site has been procured for a large infirmary for Lancaster and the district, and the charitable institutions of the town are both large and varied.

The Royal Grammar School, of which the Corporation are the governors, dates back to the fifteenth century; and the erection of large buildings, gymnasium, laboratory, and sanatorium, together with the

donations of valuable scholarships, enable it to hold its own with the great schools of the north.

A large institute has recently been erected by a Lancaster manufacturer, in which are included an art gallery, schools of science and art, a library and museum, reading room, class-rooms, and lecture theatre.

The area of the borough is 1,680 acres, its rateable value 120,000*l.*, and its population, which in 1801 was 9,030, is now 31,034.

The Borough of Leeds.

Delegates to the Congress.

Alderman JOHN WARD.
Alderman F. R. SPARK.
Councillor JOHN ATHA.
Councillor JAMES SCARBOROUGH LOE, M.R.C.S. Eng.
Councillor HANNAM.
Councillor VICKERS.
DAVIDSON HAINSWORTH, Inspector of Buildings.
J. SPOTTISWOODE CAMERON, M.D., B.Sc., Medical Officer of Health.

Leeds is a manufacturing town, and a municipal, parliamentary, and county borough in the West Riding of Yorkshire. Its population is 367,506; and its rateable value 1,279,213*l.* The parliamentary and municipal boundaries are identical. For the former purpose the town is divided into five electorial districts each returning a member to Parliament. For the latter into sixteen wards each returning three councillors. An alderman is appointed by the Council for each ward, and the Council elect one of their number as mayor every year.

Geology, &c.—Leeds is situated geologically entirely upon the carboniferous series, the strata being those of the lower coal measures and upper millstone grit. Numerous faults exist in the district, some of the principal having an east-west direction. Coal is worked at several places within the borough, and also fire-clay, especially that forming the seat of the "better bed" coal. A north-south line through the borough would divide the thin seam coals on the west from the thick seam coals on the east. The magnesian limestone is found about four miles north-east of Leeds, and the Yoredale shales on the north-west commence near Skipton, some 20 miles distant, followed by the mountain limestone at the Craven Fault, most conveniently reached from Leeds at Settle, 15 miles further on the Midland line to Scotland.

The town stands principally on the sandstones and shales, chiefly the latter, of the Elland sandstone of the lower coal measures, through which the River Aire and one or two tributaries have made deep cuttings. No part of the town is of any great altitude, but the declivities towards the river on both sides are at places pretty steep.

Manufactures, &c.—For nearly a thousand years Leeds has had some amount of importance in connexion with the woollen trade; but this importance has been much increased during the present century and since the introduction of steam. Weaving was carried on at first in private houses, but now is almost entirely done by steam power. Of recent years Leeds has not contented itself with sending out cloth in pieces but a large trade has sprung up in the manufacture of ready-made clothing. In addition to its textile manufactures and the collateral industries such as scouring, sorting, combing, spinning, dyeing, and

finishing, &c., Leeds is noted as a centre for the leather industry, including tanning, currying, leather-dressing, as well as the manufacture of the leather into boots and shoes. Situated on the coal fields, Leeds early acquired an importance in the manufacture of iron which it has retained even since the more convenient hæmatite and sesquioxide ores have been imported. Yorkshire iron is specially valued for its strength and reliability, on which account it is used for the construction of various parts of locomotive and marine engines. Water gas has recently been introduced by one Leeds firm for welding. Tools of various kinds, hydraulic and general machinery, war material, lithographic and printing machines, locomotives and agricultural machinery, nails, flax machinery, &c. are all made in Leeds. The fireclay industry is also an important one. Refractory fire-bricks, used in iron manufacture, fire-clay gas retorts, and sanitary tubes of all kinds are made in this town. Tubes of all kinds from 2 to 36 inches in diameter are now made by machinery, and a porcelain enamel glaze as smooth as earthenware can be given to them. Glazed bricks, terra-cotta articles, and decorative pottery are also largely manufactured. Soap, various chemicals, glass bottles, paper, &c. are all largely made in Leeds. About 1,300 looms and 1,700 people are employed in linen manufacture.

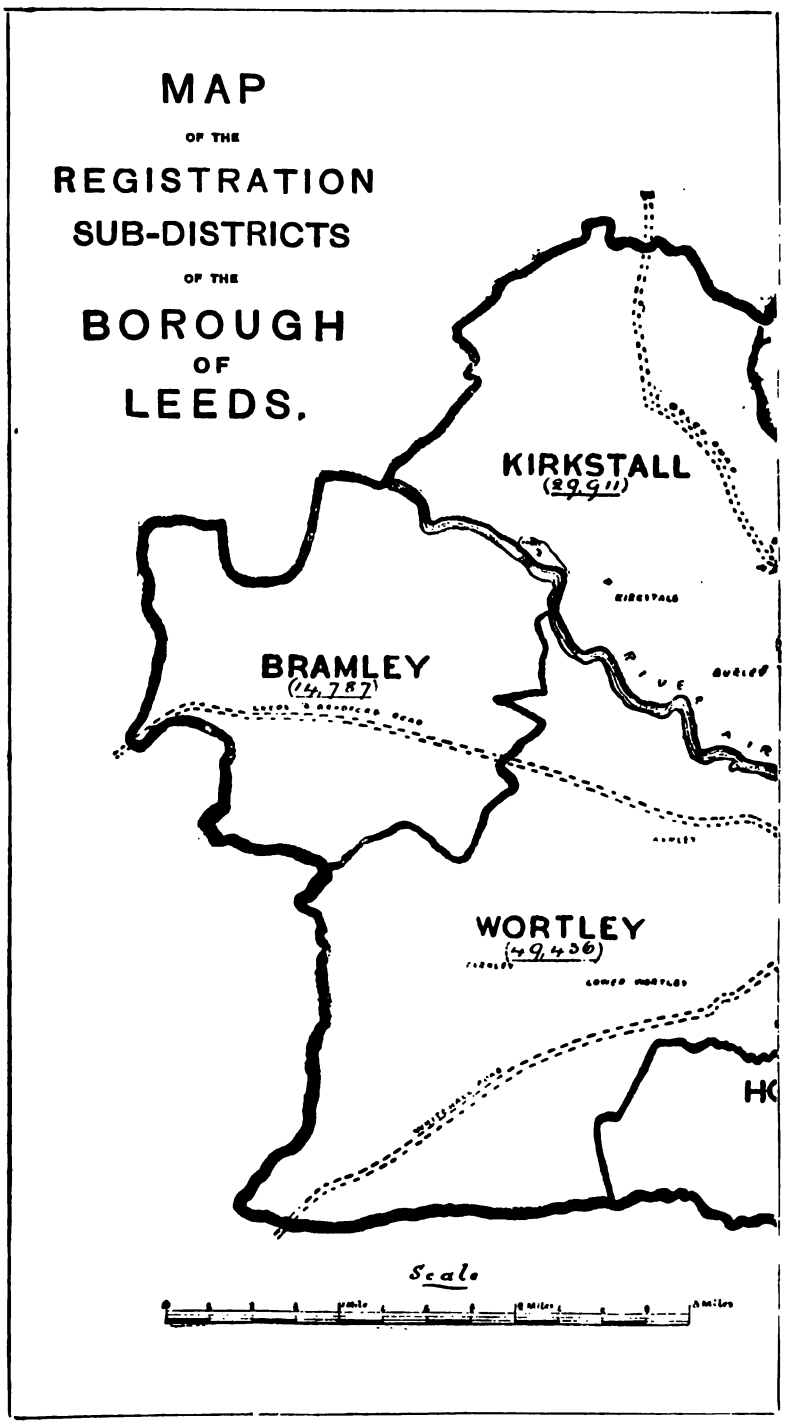
Vital Statistics.—The population of Leeds has increased rapidly during the last 90 years as is shown by the following table :—

Table showing the enumerated Population at each Census during the Nineteenth Century.

Date of Census.	Population.	Increase per cent. on previous Census.
1801 - -	53,162	—
1811 - -	62,534	17·63
1821 - -	83,746	33·92
1831 - -	119,345	42·51
1841 - -	152,054	27·41
1851 - -	172,258	13·29
1861 - -	207,149	20·26
1871 - -	259,212	25·13
1881 - -	309,119	19·25
1891 - -	367,506	18·89

Since the year 1865, when the death-rate was 31 per 1,000, the rate of mortality, notwithstanding the increase of population, has been pretty steadily decreasing, as will be seen from the annexed table :—

Quinquennium.	Death-rate.
1866–70 - -	28·7
1871–75 - -	27·5
1876–80 - -	22·8
1881–85 - -	22·4
1886–90 - -	21·7


MAP
OF THE
REGISTRATION
SUB-DISTRICTS
OF THE
BOROUGH
OF
LEEDS.
KIRKSTALL
(29,911)
BRAMLEY
(14,787)
WORTLEY
(49,436)
Scale

CHAPEL ALLERTON
CHAPELTOWN
(13,694)
POTTER NEWTON
COLDCOTES
WEST
NORTH
SOUTH EAST
WHITKIRK
(431)
HUNSLET
(38,164)
OLBECK
(23,393)
THE FIGURES SHOW THE POPULATIONS FROM
THE UNREVISED RESULTS OF THE 1891 CENSUS

1 p. 1855.

Sanitary Undertakings of the Corporation.—A constant supply of pure water is collected amongst the hills, 17 miles beyond the town, filtered and supplied to every house in the populous parts of the borough. The catchment area is 20,684 acres (10,327 hectares), and the storage capacity 3,908 million gallons (nearly 18 million cubic metres).

The system of *drainage* has been improved and extended, and various experiments as to the purification of the sewage have been made at the outfall; the A B C process was tried, but eventually abandoned. In the present *sewage works*, which have been in operation for fifteen years, the sewage is treated with milk of lime and run through large settling tanks. An attempt has been made at various places to deal with trade effluents, but at the present time the result in this respect has not been all that could have been desired.

The removal of solid refuse has received a great deal of attention, and two large destructors of twelve and fourteen cells, in Armley Road and Beckett Street, have been for several years in operation. A third of ten cells, recently erected, is now working successfully. Negotiations are at present going on for the erection of a fourth. Ashpit and market refuse, and in some cases the contents of privy middens, are subjected at these places to a destructive heat and reduced to a harmless ash, a part of which is utilised in the manufacture of building mortar.

The Corporation also possess a *fever hospital.* Originally a charitable institution, it was purchased by the Corporation in 1885 and considerably altered. It consists essentially of two wings, entirely separate from one another, each containing two storeys. Each storey of each wing has two wards with 736 and 644 square feet (68·4 and 59·8 square metres) of floor space, and five smaller wards. The nurses' apartments are contained in the centre of the building, between the two wings, but have no internal connection with either. The administration is in a separate building behind, and contains in addition to the resident medical officer's and matron's apartments and those for the domestic staff, the kitchens and a laundry supplied with steam. The boiler also supplies a Washington Lyon's disinfecting apparatus. There is also a wooden hospital consisting of seven separate detached buildings for the reception of cases of small-pox and the necessary administration. The Corporation admit patients without any charge to both hospitals.

Close to the Beckett Street destructor is a modern *disinfecting station.* The infected articles of clothing, &c. are received in an apartment distinct from the rest of the station, and are passed through one of the Goddard and Massey's steam disinfectors, specially designed for the Corporation. In this chamber they are subjected, first, to a current of warm air; afterwards, to steam under pressure; and are then dried by a further current of warm air in the chamber. Two hot-air drying chambers are also provided, to either of which the cradle containing the articles undergoing disinfection can be conveyed on a bogie carriage, to save time in drying in the apparatus itself in case of an epidemic. The steam chamber can be heated either by steam generated in the destructor, or, if the latter is not working, by a fire underneath

the apparatus. In this respect it differs from any previously constructed. There are also two bath-rooms attached to the station for the use of persons coming from infected houses.

The Corporation employ a staff of *seven disinfecters*, who stove infected houses, and remove bedding, clothing, and draperies to the station to be disinfected by steam without charge to the owners.

Other objects of interest from a sanitary point of view are the underground latrine in Briggate, and the abattoirs of the Corporation and of the co-operative society, near the cattle market, Whitehall Road, with which may be contrasted the older slaughter-houses in the yards between Briggate and Vicar Lane. Amongst insanitary conditions, attention may be drawn to the River Aire, the foul condition of which is part of the price at present paid by Leeds for the commercial prosperity of the district. The principal parks are Roundhay Park, just outside the town; the East End Park, near York Road; Hunslet and Holbeck Moors; Wortley Recreation Ground, off Whitehall Road; Recreation Ground, Town Street, Bramley; the grounds of Kirkstall Abbey; Woodhouse Moor, West Registration District; and Woodhouse Ridge, north of the Moor; besides a few smaller open spaces in the heart of the town.

Sanitary Staff.—The Sanitary Department is under the direction of the medical officer of health, who has the assistance of one chief sanitary inspector, two divisional inspectors (who assist the chief inspector in the east and west divisions of the borough respectively), and sixteen district inspectors, each of whom has charge of a municipal ward. There are special inspectors for food, drugs, and dairies (one), meat and slaughter-houses (two), smoke (one), canal boats and lodging houses (one), workshops (one). There is also a removal officer and his assistant and seven disinfecters. Street scavenging and refuse removal form two sub-departments, each having its own superintendent. The trough-closet cleansers work under the direction of the superintendent of the latter, and the three gangs of house-drain flushers under that of the former. The whole department is under the control of the sanitary committee of the Town Council.

Educational Buildings.—The Yorkshire College, attached to the Victoria University, has, in addition to the usual classes in arts and sciences, a medical school in connexion with the Infirmary, and a textile department in which the principles of dyeing, weaving, and engineering are practically taught.

The Grammar School, founded in 1552, is situated on Woodhouse Moor. The present building, erected in 1858, is in the decorated Gothic style. The Mechanics' Institute, to which is attached a modern day-school and a science school for youths, is situated in Cookridge Street. The science laboratories are well fitted up with every requisite for practical teaching.

The Higher Grade School is under the management of the School Board, and is attended by children of both sexes to the number of about 1,500. It has well equipped laboratories and school appliances. There are, in addition, schools in various parts of the borough under

the school board; and schools, also under Government inspection, partially supported by voluntary contributions, besides private schools.

Other Buildings.—The Town Hall, opened by the Queen in 1858, contains a large room—the Victoria Hall—capable of accommodating 2,000 people. The municipal council meet once a month in the council chamber. The mayor's rooms and town clerk's offices are also contained in this building, the rest of which is devoted to law courts, the law library, and the police offices. The latter are in the basement.

The Municipal Offices, opened in 1884, contain, in addition to rooms for committees of the council, the departments of the borough engineer, borough accountant, and medical officer of health, and the officers acting under them. In the same building is the Public Library with its issue and reference department respectively on the first and second storeys; and, entered by a statue gallery on the ground floor, is the Municipal Art Gallery containing a small but valuable collection of paintings. A public news room is in the same building, but reached by a different doorway.

The Parish Church is a fine modern building after the perpendicular Gothic style. The ruins of an old Cistercian abbey at Kirkstall, lately presented to the town, are about two miles from the railway station, and can be reached by tramcar. The village church of Adel, beyond Headingley, an erection of the Norman period, has a fine doorway. Headingley church is a recent building after the early English style, and Mill Hill chapel (Unitarian) after the perpendicular.

The Philosophical Society possesses a museum in Park Row specially valuable for its geological and natural history collections.

The Exchange at the foot of Park Row, below Mill Hill chapel, and the Corn Exchange in Duncan Street, are worthy of observation. The principal street in the town is Briggate, a broad thoroughfare about one-third of a mile long.

The City of Liverpool.

By J. Stopford Taylor, M.D., Med. Off. Health, and H. Percy Bulnois, M. Inst. C.E., City Engineer.

Delegates to the Congress.

James Barkeley Smith, Esq., J.P., Chairman of the Health Committee.

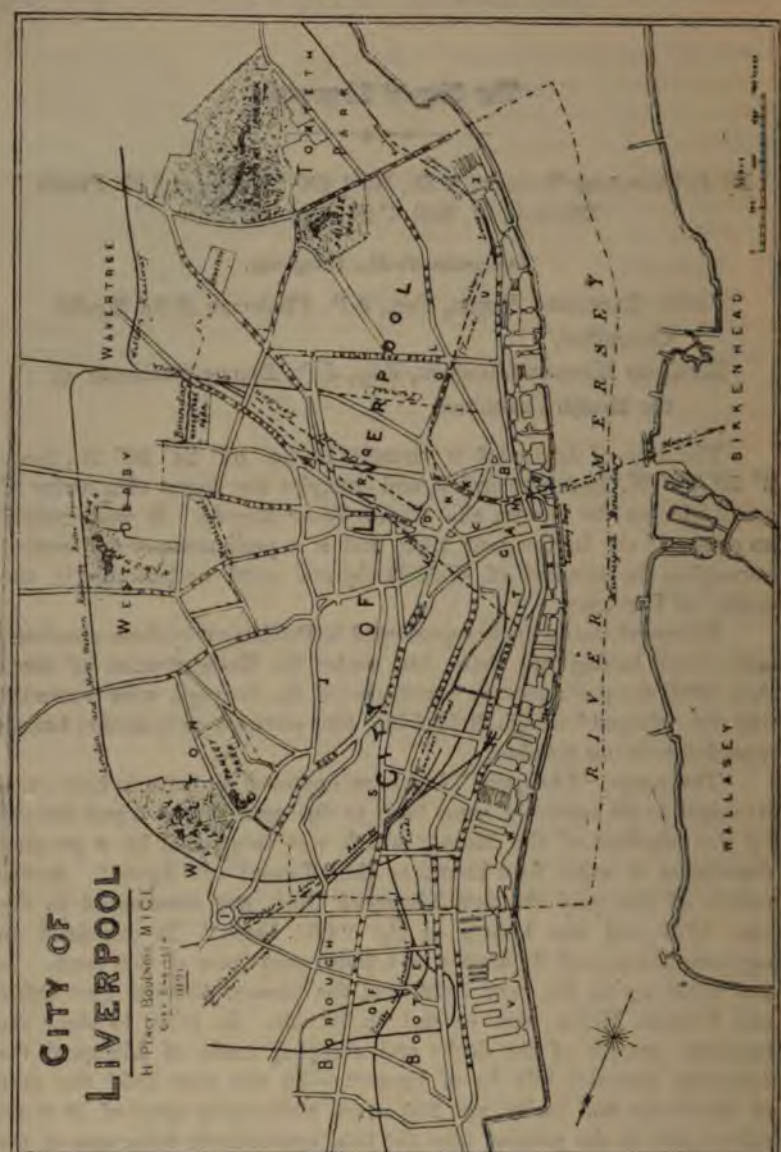
Edward Hatton Cookson, Esq., J.P., Deputy-Chairman of the Health Committee.

The city of Liverpool is situated in lat. 53° 24′ 39″ N., long. 2° 59′ 30″ W. from Greenwich, and occupies the slopes of a series of small hills on the eastern side of the River Mersey. It was created an episcopal city in the year 1880, and is a parliamentary and county borough in the hundred of West Derby and south-west division of the county of Lancaster.

Liverpool was formerly represented in Parliament by three members, each voter having two votes, but under the Redistribution of Seats Act, 1885, the parliamentary boundaries of the borough were extended and the enlarged borough divided into nine sections, each section having accorded to it one member.

The name "Liverpool" has been supposed by some to have owed its origin to the existence some time in the ages past of a pool formed by the overflow of the Mersey which was frequented by a peculiar description of water fowl known as the "Lever" or "Lyver." At the mouth of this pool the first Liverpool Dock was constructed in the year 1715 and was known as the "Old Dock." It contained an approximate area of 3½ acres with a lineal quay space of 600 yards. It was filled up in the year 1826, and the present General Post Office and Custom House were erected on its site. In order to show the immense growth of the docks and shipping trade of Liverpool the following statistics will be of interest:—In the year 1864 the area of the docks and basins was 255 acres, with a quay space of 18 lineal miles; and at the present time the total approximate water area of the docks is 381 acres with a lineal quay space of 25½ miles. This does not include the Birkenhead Docks which have an approximate water are of 164½ acres, with a lineal quay space of 9½ miles. At the beginning of the present century the tonnage of the port was 450,000; and the dock dues, &c., 23,380*l.*; these had increased in 1835 to 1,770,000 tons, and nearly 200,000*l.* respectively. The tonnage at the present time amounts to nearly 10,000,000 tons, and the dues, rates, &c., to 1,110,000*l.*

King John was the first monarch who granted a Charter to Liverpool, viz., in the year 1209; and the silver seal with a bird upon it, somewhat similar to that which is now the crest of the city arms, is still in the custody of the Corporation. In the year 1173 another Charter was granted constituting the town a port, and in the year 1227



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it was made a free borough by King Henry III. These Charters were confirmed and others added by subsequent monarchs, among the more important being one granted by King William III., by which the rights of the burgesses were confirmed and the Corporation received powers to make and annul such laws as might be thought conducive to the welfare of the town.

Although in the reign of Edward III. Liverpool could only supply one vessel and six sailors for an expedition to France, and so late as the year 1630 was only rated at 25*l.* ship money, it has now become, from its position on the River Mersey, one of the most important maritime emporiums of the world, and it is one of the greatest, if not the greatest, of the highways for all nations. Travellers of all nationalities and descriptions pass through the city, and an immense and constant stream of emigration flows in and out of the port. Prior to the year 1858 the docks and quays were under the jurisdiction of the Corporation of Liverpool, when their powers were transferred to the then newly constituted and independent body, the Mersey Docks and Harbour Board.

Previous to the year 1832 the parliamentary and municipal boundaries of the town were co-terminous, and comprised what now forms only a district of the city, viz., the parish of Liverpool. It contained an area of 1,860 acres, and a population of 165,000 persons, equal to about 88 persons per acre. Following the passing of the Reform Act of 1832 the Boundaries Act came into operation, and by this Act the parliamentary limits of the town were extended so as to include the whole of the townships of Everton and Kirkdale, and parts of the townships of West Derby and Toxteth Park. By the Municipal Reform Act of 1835 the municipal boundaries of the town were extended so as to be coincident with the parliamentary boundaries, and by this extension an area of 3,350 acres was added, making the total acreage of the borough 5,210 acres. The population of the enlarged borough was 205,000, or equal to about 40 persons per acre. With the exception of an extension of the western boundary of the city in the year 1890 from the river frontage of the docks to the centre line of the river, no extension of the municipal boundary has taken place since the Reform Act of 1835; and the population of the town since the passing of that Act, as will be seen by the following table, has been nearly trebled, with a result that at the present day Liverpool is the most densely populated city in the kingdom.

Year.	Population.	Density of Population per Acre.
1835 - -	205,000	40
1841 - -	286,487	54
1851 - -	376,065	72
1861 - -	437,740	84
1871 - -	493,346	94
1881 - -	552,425	106

From the census returns for 1891 the population of the city would appear to have decreased during the past decade from 552,425 persons to 517,951 persons, equal to a density of 99 persons per acre. It may, however, be pointed out that the population of the area between the municipal boundary and the parliamentary boundary of the borough is 70,000, and in the districts outside and immediately adjoining this area there is a further population of 50,000 persons, and if to these were added the population of the adjoining borough of Bootle, the result would be a total population of 687,000 persons. All these outside districts are the outgrowth of, and dependent upon, the port and trade of Liverpool.

Within the municipal limits of Liverpool there are now practically no available spaces on which new buildings can be erected, the land having been wholly built upon, and consequently for some years past there has been a natural and ever increasing overflow population passing out of the city into these districts just outside and adjoining the municipal boundary, with a result that the city is now closely surrounded by populous districts, which owe their origin solely to the outgrowth and expansion of the city itself. This fact was recognised by Parliament in 1885 when under the Redistribution of Seats Act provision was made for the extension of the parliamentary boundaries so as to include in the parliamentary borough the populous areas thus formed. Several proposals have been put forward from time to time for the extension of the municipal boundaries of the city, but without success. In the year 1867 the Commissioners appointed under the Representation of the Peoples Act, 1867, having regard to the extension of buildings and community of interests, recommended that what is now the adjoining borough of Bootle and parts of the districts of Walton, West Derby, Wavertree, and Toxteth Park, should be included in Liverpool, but owing to opposition these recommendations were not carried out. In the year 1880 the House of Commons rejected a Bill deposited by the Corporation for the extension of the boundaries, and in the session of 1890 the Corporation again approached Parliament and promoted a Bill for the extension of the municipal boundaries so as to make them coincident with the parliamentary boundaries (following the precedent set in the year 1835), but the Committee of the House of Commons before whom the Corporation appeared refused to grant the extension, a refusal which, besides being a serious drawback to the efficient sanitation of the city, leaves under the control of several local sanitary authorities (with differing powers and regulations) populous areas now forming parts of the northern, southern, and eastern divisions of the parliamentary borough of Liverpool.

The sanitary history of Liverpool has been that of rapid progress and development during a comparatively recent period. In the year 1840, in a report of the late Dr. Duncan on the sanitary condition of Liverpool, it is stated that in connexion with the great majority of the dwellings of the working classes in front streets there was no provision made for getting rid of their filth, except by carrying it into some of the adjoining courts and depositing it in the ashpits there; and with regard

to the courts themselves, that in general at the further end of the court two privies were provided with an ashpit between them, which, becoming speedily filled, and it being no one's business to see it emptied, would not infrequently continue full to overflowing for weeks together; in the meantime the ashes, &c. were deposited in the corners and other spaces in the courts, with the result that the atmosphere became impregnated with all sorts of nauseous effluvia. It is also stated that at that time many of the main streets were unsewered, as well as the great majority of the minor streets; and that even where sewers did exist in the latter streets they were imperfect and that, except where a natural inclination in the street existed, the surface water and fluid refuse of all descriptions stagnated on the street surfaces. The courts had no underground drains, but in some courts a narrow, open, shallow gutter existed, which was generally choked up with stagnant filth.

The scavenging and cleansing were most imperfect, the bye streets were not visited more than once a week, and no cognizance whatever was taken of the courts; and sometimes when the water pipes got out of order a court would be without water supply for weeks together.

In this report a case is cited of a whole court being inundated with fluid which had oozed through the walls from two adjoining ashpits or cesspools, and which could not escape owing to the court being below the street level and having no drain, and in this condition it remained for two or three years. In the case of another court, owing to defective privies a stratum of semi-fluid abomination covered the whole surface of the court.

Two cases also are cited in connexion with the occupation of cellars, one in which the filthy water from an adjoining court privy had oozed through the walls and collected in the cellar to a depth of two feet, while in the case of another cellar a well four feet deep into which this kind of fluid had been allowed to drain, was discovered below the bed where the family slept.

Such were some of the insanitary conditions under which people existed in the year 1840, and at that time there were no parliamentary powers to enforce the observance of sanitary regulations.

When, however, attention was drawn to these defects the Corporation did not allow a long period to elapse before taking action to remedy some of these matters, and in the year 1842 they obtained an Act entitled "An Act to provide for the health of the inhabitants of the "borough of Liverpool and for the better regulation of buildings "within the said borough," which Act empowered the Council to appoint a health committee to see that the provisions of that Act were complied with. This is believed to have been the first Act ever obtained which conferred powers to enforce sanitary regulations. It contained important provisions as to the size of rooms in houses, the width, flagging, and draining of courts, the description of cellars to be used for habitation, removal of nuisances, appointment of building surveyors, regulation of buildings, &c. In the year that this Act was passed, a Royal Commission "was appointed to inquire into and report upon the state of large towns "and populous districts with reference to the causes of disease among the

" inhabitants, and the best means of promoting and securing public health " under existing laws, the usage prevailing with regard to drainage of " lands, the erection, drainage, and ventilation of buildings, the supply of " water, whether for the purposes of health or protection from fire, and " the amendment of existing laws in these respects."

The Commissioners presented their first report in June 1844, and their second report in June 1845, and, among others, one of the principal recommendations they made was, "that the several duties of " paving, sewering, supplying of water, &c., should be combined under " one management, subject to the supervision of officers appointed " by the Crown." In the year 1845 a Bill was introduced into Parliament by a member of the Commission, (Lord Lincoln, Chief Commissioner of Woods) to carry into effect the recommendation of the Commission.

At that period there were several governing bodies controlling the sanitary operations of the city of Liverpool, viz.:—(1.) The Town Council, who exercised certain limited powers over the whole borough. (2.) The Commissioners for the parish of Liverpool, who had the control of the paving, sewering, and watering of the streets in that district of the city known as the parish of Liverpool. (3.) The Commissioners for the township of Toxteth Park whe possessed similar powers over their district.

The townships of Everton and Kirkdale and West Derby were regulated by a General Highway Act, but these townships were without any statutory provisions as regards sewerage. The water supply of the town was in the hands of two private companies.

In the year 1846 the Corporation obtained an Act of Parliament, known as the Liverpool Sanitary Act, 1846, by which the Town Council became the sole governing sanitary authority over the whole borough. By this Act the Corporation had conferred upon them full powers for the paving, sewering, and drainage of the town, together with many other important powers for its sanitary improvement. This Act also empowered the Council to appoint " subject to approval by one of Her " Majesty's Principal Secretaries of State, a person duly qualified as a " civil engineer to act as a local surveyor," and by the Liverpool Sanitary Amendment Act, 1854, it is is also enacted that he shall be called and known as "the borough engineer." Liverpool is the only town where the appointment of the borough engineer must receive the approval of one of Her Majesty's Principal Secretaries of State, and where the title "borough engineer" is conferred upon him by parliamentary enactment.

The Liverpool Sanitary Act, 1846, also provides for the appointment of "a legally qualified medical practitioner of skill and experience" as medical officer of health, his appointment being subject to approval by one of Her Majesty's Principal Secretaries of State. This is believed to have been the first mention of such an officer in any sanitary or other Act of Parliament. For many years Liverpool was the pioneer in sanitary legislation, and the Liverpool Sanitary Act, 1846, was practically the precursor of the Towns Improvement Clauses Act, 1847. This

was followed by the Liverpool Sanitary Amendment Acts of 1854 and 1864, the Liverpool Improvement Act, 1867, and the Liverpool Improvement and Waterworks Act, 1871, which in their turn practically formed the basis of the Public Health Act of England, passed in the year 1875.

In the year 1847, during one of the Irish famines and the consequent influx into Liverpool of an immense number of Irish people, the death rate rose to 63·5 per 1,000, due principally to fever. Owing, however, to the energetic way in which the Corporation after this warning set to work, and have since continuously carried out every sanitary measure calculated to promote the health of the inhabitants of the city, the death rate of 63·5 has been gradually reduced as follows:—from 63·5 in 1847, to 32·5 in 1861–70, 28·4 in 1871–80, and 25·1* in 1881–90.

In the year 1848 the then borough engineer (the late Mr. James Newlands, M. Inst. C.E.) prepared a comprehensive report on the sanitary requirements of the borough, embracing a complete scheme of sewerage and drainage, besides other sanitary and improvement works and sanitary regulations so as to raise the borough to a proper sanitary standard. This report was approved by the Town Council on the 4th July in that year, and generally speaking the whole of the recommendations contained in that report were subsequently carried out and acted upon.

Among other important sanitary improvements the substitution of waterclosets for privies has for many years past been systematically and continuously carried out, until at the present time few, if any, privies exist in the city. By the Liverpool Building Act, 1842, owners were required to provide sufficient privy and ashpit accommodation to their property; but previous to the passing of that Act, the mode of construction, &c. of such privies appears to have been left entirely to the discretion of each individual owner of property, and up to the year 1846, connexions between the privies and public sewers were prohibited. Under the provisions of the Liverpool Sanitary Act of that year the sewers, which had hitherto vested in the Highway Board, were vested in the Corporation, and owners of property were encouraged and even compelled to connect such privies with the public sewers.

From a report of the health committee, made in the year 1849, it appears that the conversion of privies into waterclosets was then anticipated; but, probably owing to difficulties in connexion with the water supply, little or no action was taken by the Corporation until the year 1860, when they began to withhold their approval of plans which did not provide for ample watercloset accommodation. In the year 1863 the medical officer of health certified periodically such privies and cesspools as required converting into waterclosets, the property owners paying the cost of conversion, and the Corporation providing the requisite drainage. This practice was continued, and up to the year 1876, 16,176 privies had been so converted. The present medical officer of health (J. Stopford Taylor, M.D.) was appointed in 1876, and from

* Based on the census return for 1891.

that year to the year 1885 no less than 18,000 privies were converted into waterclosets, until, as has already been stated, very few, if any, privies now exist in the city.

The whole of the sewage of Liverpool is discharged into the tidal River Mersey, by ten outfall sewers of large capacity, having a drainage area of 6,359 acres. At the present time there exist in the city 555 miles of sewers, consisting of 258 miles of brick and pipe sewers; 267 miles of passage sewers; and 30 miles of main outfalls, ranging from 5 feet × 3 feet to 9 feet in diameter. All the old sewers are being systematically repaired, and up to last year 107 miles of such sewers had been dealt with. Generally speaking all the main sewers are constructed so as to be self-cleansing; but the few that are not self-cleansing are flushed periodically by large movable tanks placed over a manhole on the sewer. Each tank contains 1,800 gallons of water, and discharges its contents into the sewer through a valve at the bottom in 28 seconds.

All passage sewers are flushed periodically four times a year, and the whole of the private drains are regularly and periodically flushed twice a year, by and at the cost of the Corporation, involving an expenditure of approximately 3,000*l.* per annum. Hospitals, and other similar public institutions, have their drains flushed, free of charge, at intervals varying from a fortnight to three months.

Prior to the year 1879 sewerage works were executed by contract, but since that year the whole of the works have been executed by the Corporation staff.

The length of roads (exclusive of back passages, which may be taken as about the same length as the roads) is 276 miles, of which length 18 miles are unadopted. Formerly the carriageways were macadamised, or paved with boulders, and later on with large size setts, with wide joints grouted with gravel. In the year 1871 impervious pavements were introduced, consisting of granite or syenite setts of suitable dimensions (regulated by the traffic or other local circumstances), with close joints, grouted with hot asphalte and creosote oil, and laid on a Portland cement concrete foundation, 6 inches deep.

Of the 258 miles of adopted streets, about 101 miles (embracing an area of 1,702,814 square yards) have been constructed with impervious pavements, as follows: Granite or syenite sett pavement, 1,651,000 square yards; natural compressed asphalte, 27,000 square yards; wood, 18,000 square yards; and granolithic, 6,800 square yards. With the exception of such pavements as compressed asphalte and granolithic, all works in connexion with the construction of pavements in public streets are executed by Corporation workmen.

A complete system of tramways has been laid, branching out into every part of the city and the adjoining districts. The length of lines within the city is 47½ miles. The whole of the tramways in the city were constructed by the staff of the Corporation, and are maintained by the Council, the lines being leased to a private company for a term of years at a fixed rental per annum.

Prior to the year 1867 the removal and disposal of nightsoil, mixed with cinder ash and domestic refuse, were executed by contract; but

since that year the Corporation have executed with their own staff the whole of the scavenging, cleansing, and disposal of town refuse. They have erected large stables and workshops in different parts of the city, and keep a large stud of horses in each of these stables. Two wharves have also been constructed on the banks of the Leeds and Liverpool Canal and adjoining the Lancashire and Yorkshire Railway, and in addition five other wharves are rented, where the refuse is collected with a view to its disposal to farmers and others.

Up to the year 1870 little or no difficulty was experienced in the disposal of dry ashpit refuse in many available disused stone quarries and excavated lands; but owing to extension of buildings this mode of disposal became objectionable, and the Corporation acquired a farm (known as the Carr Hall Farm), 17 miles distant from the city, and containing an area of 70 to 80 acres; and, between the years 1871 and 1874, 90,000 tons of refuse from the northern portion of the city were deposited on this farm. Owing to objections having been raised to this mode of disposal of the refuse it was discontinued, and arrangements were then made with farmers and others who had land on the banks of the Leeds and Liverpool Canal, distant within 10 miles from Liverpool, to take refuse unsuitable for manure, the Corporation paying them from 8½*d.* to 10½*d.* per ton and defraying the cost of transport along the canal and discharging. Between the years 1874 and 1885 upwards of 700,000 tons were thus disposed of.

For the disposal of refuse from the southern portion of the city the Corporation rented several acres of marsh land abutting upon the margin of Bromborough Pool in Cheshire, the level of which it was proposed to raise 20 feet, and cover over with soil in sections for purposes of cultivation. Up to January 1878, 100,000 tons of refuse were deposited, when it had to be discontinued in consequence of objections being raised by the rural sanitary authorities. During the following two years refuse from this end of the city was used for filling up low-lying land on the margin of the upper reaches of the Mersey, and the Lancashire Canal, and nearly 17,000 tons of refuse were disposed of in this way. Meanwhile the Corporation had under consideration a number of schemes with a view to the permanent solution of the question, and amongst others were the following:—(*a.*) Destruction by burning. (*b.*) Reclamation of land from the sea, near the mouth of the River Dee. (*c.*) Depositing on the fore-shore near Ainsdale and Formby. (*d.*) Depositing over the entire area of Carr Hall Farm.

There being at the time more or less objections to these respective proposals, it was ultimately decided to convey the refuse to sea by steam hopper barges to a point outside the bar of the River Mersey about 22 miles distant from the Liverpool Landing Stage. Two steam hopper barges have been built, one in 1880 and the other in 1884. The first one, designed to carry 380 cubic yards of refuse, conveys to sea the refuse from the southern portion of the city; and the second barge, constructed to carry 530 cubic yards of refuse, takes to sea refuse from the northern portion of the city.

Since the appointment of the present city engineer (H. Percy Boulnois, M. Inst. C.E., F.S.I.) it has been decided to erect a 12 cell refuse destructor with Jones' cremator and all the most recent improvements, and the work is now drawing to completion. It is expected that this destructor will destroy about 600 tons of refuse per week, leaving a residuum of clinker and ash of 120 tons, which will probably be utilized for road-making purposes.

The Corporation have from time to time promoted important Improvement Acts for the widening, &c. of existing streets and the carrying through of new streets. Since 1858 no less than eleven such Acts or Provisional Orders have been obtained authorising an approximate expenditure of about two and a quarter million pounds sterling. Large amounts have also been expended in providing parks and recreation grounds for public use, as follows:—Shiel Park, containing 15 acres, and costing 9,000*l.*; Newsham Park, 160 acres, cost 93,471*l.*; Stanley Park, 100 acres, cost 164,488*l.*; Sefton Park, 382 acres, cost 410,266; Wavertree Park and Botanic Gardens, containing 34 acres, cost 29,455*l.*; Mount Gardens and Walk, costing 10,920*l.*; Kensington Gardens, costing 34,995*l.*; Kensington Reservoir, costing 556*l.*; Aubrey Street Reservoir, costing 300*l.*; Browside Recreation Ground, costing 440*l.*; Shaw Street Recreation Ground, costing 9,227*l.*; Prince's Boulevard, costing 12,000*l.*; and five churchyards laid out as gardens at a cost of 6,065*l.*; making a total of 781,183*l.*

Under the provisions of the Liverpool Sanitary Amendment Act, 1864, and other local Acts, approximately 3,700 houses have been Presented, or reported to the Council by the medical officer of health with a view to their demolition; and the sites of the houses thus cleared have either been filled up and levelled and left as open spaces, or houses for the labouring class, in full accordance with the existing building regulations, have been erected thereon. The property dealt with has been principally confined to courts, back-to-back houses, or such houses as were without the means of proper ventilation. It is estimated that the expenditure incurred by the Corporation in acquiring insanitary property has been 226,000*l.*

In addition to the foregoing most important improvements carried out under local Acts, the Corporation availed themselves of the powers conferred by the Artizans and Labourers Dwellings Act, 1875, and cleared an "unhealthy area" known as Nash Grove. This area contained 22,487 superficial yards of land, of which 3,717 yards consisted of public streets, and the balance was occupied by low class unhealthy dwellings, buildings, and yards used for trade purposes. The population displaced was 1,310, of which number 1,100 belonged to the poorer classes. The density of the population on this area was 282 persons per acre. On a portion of the site thus cleared the Corporation have erected blocks of artizans' dwellings, known as Victoria Square, occupying an area of 9,195 superficial yards, including an open quadrangle of 5,271 superficial yards, the cost for land and buildings being 68,148*l.*

These dwellings contain 271 tenements and a superintendent's house, including 86 3-roomed tenements at a rental of 5*s.* to 5*s.* 6*d.*

per week; 164 2-roomed tenements at a rental of 3*s.* 6*d.* to 4*s.* 3*d.* per week; 21 1-roomed tenements at a rental of 2*s.* per week. On other portions of Nash Grove four blocks of labourers' dwellings have been erected at a cost of 16,000*l.* including land.

The approximate total cost of these artizans' and labourers' dwellings was 142,000*l.*

The city is amply lighted with 545 special lamps having an illuminating power varying from 50 candles to 64 candles, consuming 16 cubic feet of gas per hour; and 10,743 ordinary lamps of 16-candle power, burning 4 cubic feet per hour; the average distance apart of the lamps being 52 yards.

In the year 1873 it was felt that the supply of water to Liverpoool should be extended, with the result that after many schemes had been discussed it was decided to construct an artificial lake in the valley of the Vyrnwy in Wales, and to bring the water from thence by aqueducts to Liverpool. It would occupy too much space to describe in detail the engineering grandeur of this undertaking; the following particulars will, however, be of interest:—

General Dimensions of the Lake.—When the lake is full to the overflow, the surface of the water is 825 feet above the sea (Ordnance datum), and the principal dimensions are:—Superficial area, 1,121 acres; length, 4¾ miles; average width, ½ mile; greatest depth, 84 feet; contents in gallons, 13,125,000,000; in cubic feet, 2,103,000,000; in tons of water, 58,000,000. The length of the road around the margin of the lake is 11¾ miles, exclusive of the road over the dam.

Gathering Ground and Yield.—The area of the gathering ground from which water is collected is 18,000 acres, but the Corporation have power to divert two neighbouring streams, the Cowny and the Marchnant, with a gathering ground of 5,200 acres, so that when all the works contemplated by the Act of 1880 have been carried out, the lake will have a total watershed of 23,200 acres; and it is estimated that the rainfall on this area will yield an average daily supply of about 53,000,000 gallons of which 40,000,000 gallons will be available for Liverpool, after delivering compensation water to the river, as provided by Act of Parliament.

The Dam.—The dimensions of the wall are as follows:—

Total length along the top, 1,165 feet; height from lowest part of foundation to parapet of carriageway, 161 feet; height from river bed to sill of overflow (under the roadway), 84 feet; greatest thickness at base, 120 feet; width of roadway over top of dam (between the parapets), 19 feet 10 inches; the batter or slope of the wall on the front or water side is 1 horizontal in 7¼ vertical; the slope of the back wall is 1 horizontal in 1½ vertical; the total quantity of masonry in the dam is 260,975 cubic yards; the total weight of the masonry is 510,000 tons; the quantity of earth and stones that had to be excavated for the foundations was 220,890 cubic yards; and the refilling at the front and back of the wall amounted to 79,501 cubic yards.

The following few leading facts with reference to the Liverpool water supply will also be of interest:—By an Act of Parliament passed

in the year 1847, the Corporation of Liverpool obtained power to purchase the undertaking of two private water companies, who then supplied the town with water. Both of these companies derived their supplies exclusively from wells in the new red sandstone, and they distributed water to their customers only twice or three times in a week, and for not more than two or three hours at one time. By the same Act of Parliament (1847) the Corporation were authorised to carry out what was known as the "Rivington Pike" scheme, designed by Mr. Hawksley. This was a project for impounding the head waters of the Rivers Douglas, Yarrow, and Roddlesworth, by the construction of large reservoirs in a hilly and sparsely populated district between Bolton and Blackburn in Lancashire. These works were commenced in the year 1852, and were finished in 1857. There are six reservoirs, with a total surface area of about 600 acres. The total length of the reservoirs is 5½ miles. Their total contents, when full, is 4,200,000,000 gallons. The area of the gathering ground is 10,000 acres. The elevation of the watershed ranges from 425 to 1,500 feet above the sea level. All the water is filtered. There are altogether eight filter beds, with a total filtering area of 6¼ acres. The aqueduct from Rivington to Prescot, near Liverpool, is 25 miles in length, and with the exception of one mile of tunnel at Hilton House, it consists of a cast-iron pipe of an uniform internal diameter of 3 feet 8 inches. The quantity of water thus available for Liverpool, after delivery of compensation water to the rivers, is about 12,000,000 gallons per day.

Several of the wells acquired by the Corporation in 1847 have been abandoned, but new wells in the same new red sandstone formation have been sunk as the requirements of the district have increased. At the present time water is pumped from four deep wells; one in Bootle, one in Lodge Lane, Windsor, near the Edgehill Station of the London and North-Western Company, one at Green Lane, Old Swan, and one at Dudlow Lane, on the road between Wavertree and Woolton. The total yield of these wells is about 6½ million gallons per day.

In addition to the foregoing important sanitary works and measures carried out by the Corporation with a view to the promotion of the health and well-being of the inhabitants of the city, they have erected and maintain large public baths and washhouses, wholesale and retail markets, disinfecting apparatuses in different parts of the city, hospitals for infectious diseases, and other large public buildings for the administration of justice and public entertainments, reading rooms, libraries, museums, &c.

It is satisfactory to know that the large expenditure on public works incurred by the Corporation has transformed Liverpool from what it was described in the year 1847 "as the most unhealthy town in the United Kingdom" with a death rate of 63·5 to one of the healthiest of the large cities of the Empire with an average death rate for the past ten years of 26·1 per 1,000.

Morecambe.

Morecambe—formerly a small fishing village known as Poulton-le-Sands—is situate on the south shore of Morecambe Bay in 54° 4′ 30″ N. lat. and 2° 51′ 30″ W. long., in the county of Lancaster. The district consists of three hamlets, viz.:—Poulton, Bare, and Torrisholme, the total area being 1,725 acres. In 1811 the population of the whole district was 277. In 1852 a local board was established,—The "Poulton, Bare, and Torrisholme Local Board," the population at that time being 1,301; in 1889 the name was changed to "Morecambe Local Board." By the census of 1891, the resident population had increased to 6,476, having nearly doubled itself during the past 10 years; the rateable value for 1890 was 36,056*l.*

At the time of the formation of the local board there were no sewers in the district; sanitation being practically unknown, the streets and roads were used as the natural sites for storing manure, &c. Since the formation of the local board (and especially during the last 20 years) the town has been efficiently sewered; through the unremitting vigilance of the board in sanitary matters, it now enjoys a singular immunity from disease, and has become a very popular seaside resort, 10 to 15 thousand persons visiting it daily in the season.

The water-supply, unlimited in quantity and excellent in quality, —is obtained by gravitation; the following is Dr. Wigner's analysis and report:—

"Total solid matter - -	3·00 grains per gallon.
Loss on ignition after deducting combined carbonic acid - -	1·30 ,,
Lead and copper - -	none.
Iron, - - -	very slight traces.
Chlorine, calculated as chloride of sodium - - - -	1·17
Hardness before boiling - -	1·5° (Clark's scale)
,, after ,, - -	1·5° ,,
Nitrogen, as ammonia - -	0·0019
,, albuminoid ammonia -	0·0027
,, nitrates - -	0·0280
,, nitrites - -	none.
Total nitrogen in these four parts	0·0326
Oxygen absorbed by organic matter	0·0780

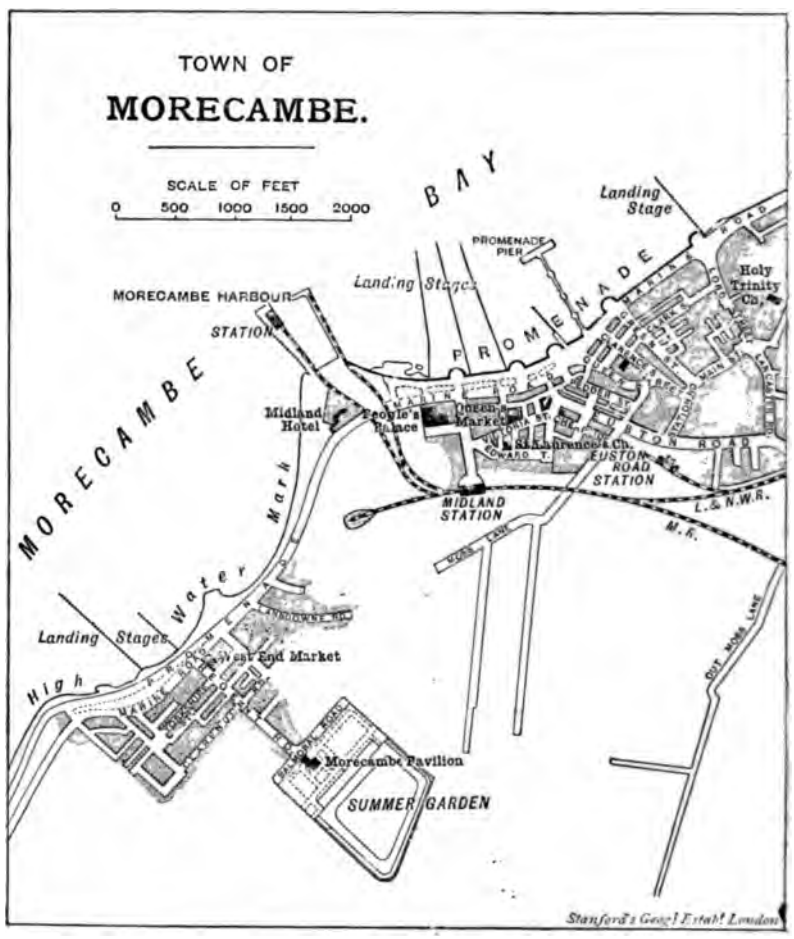
As regards mineral constituents, this is an extremely good water, and as regards nitrogenous compounds it is satisfactory. It must be summed up as an excellent water-supply."

The town is situated at a point commanding a splendid and uninterrupted view of the Lake Mountains, and boasts of a pleasure pier and a harbour pier, winter gardens and summer gardens, Midland, and London and North-Western railway stations. It is a convenient centre for excursions to Windermere, Blackpool, Furness Abbey, Barrow

1 p. 1855.

Grange, Limesdale, and other places of interest. The boating and fishing are excellent. There are two tramway companies; and powers have been obtained for lighting the town by electricity.

The local board have expended the sum of 14,900*l.* in building seawalls and in providing a promenade nearly two miles in length, one of the finest in England.



The City and County of Newcastle-upon-Tyne.

Delegates to the Congress.

Councillor JOSEPH BAXTER ELLIS (Mayor).
Councillor STEPHEN QUIN (Sheriff).
Alderman THOMAS BURGESS WINTER.
Councillor THOMAS BARKAS SANDERSON.
Councillor HUGH MORTON.
HILL MOTUM (Town Clerk).
WILLIAM GEORGE LAWS (City Engineer).
HENRY EDWARD ARMSTRONG, D.Hy. (Medical Officer of Health).

The general aspect of the city is toward the south. The altitude above sea level (high-water mark) toward the north-west ranges from 12 feet at the quay to 355 feet at a distance of about 1½ miles; the rise from the riverside in an easterly direction is 180 feet in about three quarters of a mile. The facilities for drainage are therefore good.

The slope from the quay to the north-west is intersected by five ancient watercourses along which in former times the domestic refuse was discharged. Four of these are now covered in and converted into sewers, which consequently are well and continuously flushed.

Newcastle was originally founded by the Romans for the purpose of war, and since then has undergone many changes of fortune and of structure.

The area of the city is now 5,371 acres, or 8½ square miles; its buildings cover 2,600 acres, or four square miles; the number of houses is 25,700, equal to 10 per acre. There are 15 banks, 60 churches, and 30 chapels in the city.

The population was in 1801, 33,000; in 1821, 42,000; in 1841, 70,500; in 1861, 109,000; in 1881; 145,400; and in 1891, 186,400, or at the rate of 34·7 persons per acre; the increase in last decade amounts to 41,000 or 28¼ per cent.

There are 159 miles of streets and roads in the city, of which 34 miles are macadamized, 113 paved and 12 unpaved. The total length of the sewers is 149 miles, and the sewer ventilators are 4,500 in number.

Since 1860 the following sums have been expended on sanitary improvements:—

On sewers, 164,500*l.*; on paving, 320,000*l.*; on roads and scavenging, 414,500*l.*; making a total of 899,000*l.*

There are three old established and three modern public baths and wash-houses, which cost 50,000*l.*

The public library contains over 70,000 volumes, and cost 23,000*l.* The Literary and Philosophical Society's library contains 45,000 volumes.

The town wall, which is said to have been first built by William Rufus and was afterwards extended about the middle of last century, enclosed

PLAN OF THE CITY OF
NEWCASTLE UPON TYNE
SCALE
TWO YARDS
TWO YARDS
TWO MILES
RIVER TYNE
TOWN MOOR
NUNS MOOR
CASTLE LEAZES
CASTLE
CASTLE GARTH
JESMOND DENE
JESMOND VALE
JESMOND GARTH
JESMOND DENE
JESMOND DENE
JESMOND DENE

an area of 164 acres. This led to the formation of numerous narrow streets and lanes crowded together, and having very little light or ventilation. Most of these, known locally as "Chares" or "Entries," have disappeared; others remain to this day and interfere with sanitation.

Of the present area of the city, no less than 1,373 acres consist of public parks or recreation grounds in various parts of the city, including the Town Moor (1,031 acres); the beautiful and romantic Jesmond Dene, the gift of Lord Armstrong; the Cruddas Recreation Grounds, the gift of W. D. Cruddas, Esq.; the Leazes, and five other ornamental parks in various parts of the city provided by the Corporation.

The water of the city is supplied by the Newcastle and Gateshead Water Company, whose collecting grounds lie in the County of Northumberland, at a distance of about 30 miles to the west of the city. In that neighbourhood are several of the reservoirs; others fed by these and otherwise, are situated about 12 miles from Newcastle; and still nearer the city are the filter beds, service reservoirs, &c. The water is good in qnality and is supplied under constant pressure. The reservoirs have a total capacity of 3,040 million gallons. The population supplied in and round Newcastle numbers 370,000, and the daily consumption is 40 gallons per head, or 14¾ million gallons per day.

In 1865 the Corporation obtained extensive powers under a local Act, for improving the sanitary condition of the city. Soon after this a large number of streets, previously defective, were put into good order; the sanitary staff was increased; a house-to-house inspection was carried out; upwards of 500 unhealthy dwellings were closed in less than two years, and of these a large number were pulled down. Rooms for many of the displaced persons were temporarily provided elsewhere; and active steps were at the same time taken to abate the overcrowding, which was great. Many other sanitary improvements were also effected. Under the Artizans and Labourers Dwellings Act, 1875, the old dilapidated property known as the New Pandon group, consisting of the dwellings of 958 persons was acquired by the Corporation and demolished in 1878. The hollow in which these houses stood was filled up and is now crossed by two large thoroughfares. Adjoining this area was another, the Old Pandon group, consisting of similar dwellings occupied in 1875 by 943 persons. Most of these houses were pulled down. The total expenditure out of the Corporate funds on these areas was 63,800*l.* In 1883–84 a house-to-house inspection of the city was carried out by the Health Department, the staff of which was strengthened for the purpose by the addition of a dozen inspectors. This inquiry led to the disclosure, and subsequently to the remedy, of a very large number of defects, as also to the formation of a useful sanitary register of the dwellings in the city. At the present time action is being taken under the Housing of the Working Classes Act, 1890, for the closure of many of the old and dilapidated dwellings still remaining. The Corporation have resolved to erect a common lodging-house for males and another for females, capable of accommodating 400 persons, and also a block of 50 single-room tenement dwellings to be let at low rentals.

In 1882 the Corporation erected on the Town Moor a new hospital of 24 beds for the treatment of small-pox, in place of the then existing small-pox wards in the ground of the old fever hospital at Bath Lane. In 1888 they also opened a new hospital for infectious diseases other than small-pox. This is built on part of their estate at Walker, about 3 miles from the centre of the city. This hospital consists of five ward pavilions (105 beds), administrative block, laundries, disinfecting station, lodge, stabling, &c., &c., according to the most modern and improved principles. The area of the site is upwards of 11 acres, thus allowing space for future extension. Admission to the general wards is free. The cost of the building was 23,476*l.*, and that of furniture and fittings, 3,186*l.* The notification of infectious diseases has been in operation under a local Act since 1882. On the receipt of every notification of a case of infectious disease, the action taken by the Health Department is as follows:—1. A special inspector attends at the infected house, without delay, and makes a careful and exhaustive inquiry into the circumstances, filling up on a printed form details relating to all the probable channels by which infection may have been received or is likely to be propagated, the sanitary condition of the premises, water and milk supplies, &c.: all defects noted receive attention as soon as practicable. 2. The removal to hospital of all suitable cases is recommended, and, wherever possible, effected. 3. Printed advice and instructions as to the best means of preventing the spread of infection are left at the house in every instance, and, where requisite, disinfectants are supplied gratis. 4. The attendance at school of children from infected houses is prohibited. The principals of schools attended by children in whose houses there is infectious disease are informed by circular, and cautioned not to allow any such child to attend school until they have received a certificate from the Medical Officer of Health as to the final disinfection of the house. 5. A printed form of certificate stating that the infected premises and articles are ready for final disinfection is also left with the householder for the signature of the medical attendant on the termination of the case. This certificate when duly signed is forwarded to the medical officer of health, after which the special inspector sees to the final disinfection. 6. The bedding, &c., are removed to the steam disinfection station, where it is fumigated and returned without charge to the owner. The infected premises are also fumigated by the inspector.

The Health Department of the Corporation is placed by the city council under the entire control of the medical officer of health. It comprises the following divisions—(*a*) The department proper of the medical officer of health with the special inspectors for infectious diseases, clerks, &c. (*b*) The hospitals for infectious diseases and the requisite staffs. (*c*) The work of the inspector of nuisances, and the inspectors of dairies, slaughter-houses, food of all kinds, and adulterations, with the requisite staffs. The inspectorial staff includes an inspector of nuisances and eight assistant inspectors, two special inspectors for infectious diseases, an inspector of provisions, slaughter-houses, dairies, &c., and his assistant; and two subordinate officers.

The general death-rate of the City, which for the 10 years 1871–80 was 25·8 per 1,000 population, fell during the succeeding decade to 23·8, as calculated on a population which last Census has proved to have been greatly under-estimated. The death-rate from the "Chief Zymotic Diseases," * which for the former of these decades was 4·6, fell during the latter to 3·0 per 1,000, having been 3·6 for the quinquennial 1881–85, and 2·5 for that of 1886–90. The rate for the year 1890, if calculated on the population enumerated in April, 1891, is 1·8 per 1,000.

Among the older charitable medical institutions of Newcastle may be mentioned, the Royal Infirmary (270 beds), and the Newcastle Dispensary. Among those more recently erected may be named (1) the Fleming Memorial Hospital for Sick Children, erected by the late John Fleming, Esq., and opened in 1888; (2) the Home for Incurables, provided by the Corporation out of the funds of the Mary Magdalene Hospital, (No. of beds, 30; cost of buildings, 5,886*l.*; and that of furnishings, 1,165*l.*).

Two new College Buildings have lately been added to the city, viz., those of the College of Medicine and the College of Science of the University of Durham. These have each taken the place of less commodious structures, previously occupied by the respective colleges in a more central situation. The cost of the new premises of the College of Medicine up to date is 30,000*l.*, and that of the College of Science 25,000*l.* Large extensions are contemplated for each of these colleges.

The Tyne has during late years been immensely improved as a port by the River Commissioners. Since the formation of that body in 1850 about 100 millions of tons of material have been removed by dredging from the river and docks; 5,000,000*l.* have been spent in widening and deepening the river, and in other improvements, including the removal of shoals and dangerous projections of land, the making of piers, embankments, docks, quays, warehouses, a swing-bridge 559½ feet in length, including two opening spans of 104 feet each. The piers at the mouth of the Tyne were begun in 1856, and are still in progress. When completed the North Pier will be 2,472 feet, and the South Pier 4,670 feet in length. The amount of sea water now coming up the Tyne to Newcastle and above it has been much increased by the deepening of the river, to the sanitary and general benefit of the inhabitants and the great development of commerce. Upwards of 14,000 ships now annually arrive in the Tyne. Shipbuilding is one of the principal works of the port. The Tyne is the principal coal port in the kingdom.

The sanitary administration of the port is in the hands of the River Tyne Port Sanitary Authority, a body formed of representatives from the councils of Newcastle, Gateshead, Tynemouth, South Shields, and Jarrow, and the Local Boards of Walker, Wallsend, Willington Quay, Felling, and Hebburn. The staff of the Health Department of the authority comprises a medical officer of health, assistant medical officer of health, inspector of nuisances, two assistant inspectors, &c. The

* Small-pox, scarlet fever, typhus, enteric and continued fevers, measles, diphtheria, whooping cough, and diarrhæa.

authority has a floating hospital of 30 beds, in three blocks, erected on a deck 140 feet in length by 80 feet in width. This deck rests on 10 pontoons. The cost of this hospital, which was launched in 1886, was 5,000*l.* Adjoining the hospital, to which it is moored, is the Dutch Galleot "Alliance," on the deck of which is erected a house for the resident staff and administrative department generally. The Health Department is provided with a steam launch, the forecabin of which is fitted up for the removal of patients. The offices of the authority are in the Town Hall, Newcastle. The inspector's station, where the inspector of nuisances resides, is at South Shields, overlooking the Port. The number of vessels annually inspected is over 12,000.

Paignton.

The town of Paignton is pleasantly situated on the western shore of Torbay. Its extensive frontage to this magnificient bay is protected by a sea-wall, and provided with an excellent marine drive. The houses on the Esplanade, which face the sea, are set back from the shore a considerable distance, and in the intervening space are many acres of green sward secured for ever as a public recreation ground. The beach is nearly a mile in length; and, consisting almost entirely of sand sloping very gradually seawards, affords ample facilities for bathing with perfect safety at all periods of the tide.

During the past 10 years Paignton has rapidly become popular, not only as a place of health and summer resort, but also as a place for permanent residence, the population having increased from 4,610 in 1881 to 6,785 in 1891, a gain of over 47 per cent. The rateable value of the property included within its area has risen from 11,000*l.* in 1863 to 36,890*l.* 10*s.* in 1890. The town, with its surrounding district, comprising altogether an area of 5,092 acres, forms the Urban Sanitary District of Paignton, with the Local Board of Health as the Urban Sanitary Authority.

Drainage.—In 1867 a thorough system of drainage was undertaken and carried out under the direction of R. P. Brereton, Esquire, of Westminster. By this means the whole of the sewage is discharged into the sea, at a point sufficiently remote to prevent its being washed back on to the shore. The work was completed in 1887 at a cost of about 12,000*l.*

Water Supply.—The reservoir situated at Blagdon, about three miles from the town of Paignton, and the rest of the waterworks, originally the property of a company was purchased by the local board on behalf of the public in the year 1888, at a cost of 10,500*l.*; and a large additional sum has since been expended in extensions and improvements, so as to secure a continuous supply of pure water.

Infectious Diseases Notification.—The Infectious Diseases Notification Act was adopted and came into force throughout the town and district on January 1st, 1890. It has been found a useful measure, though the amount of such disease is usually very slight in the locality, only one case having been notified during the first half of 1891.

Sanitation of New Buildings.—Great care is taken to ensure the perfection of the sanitary arrangements in all new buildings, each drain being submitted to the "smoke test."

Its natural advantages, good drainage, and water supply, together with the constant care shown by the local sanitary authorities in all matters pertaining to sanitation, combine to render Paignton a very healthy town. The annual amount of sickness is slight, and the yearly death-rate a very low one. During the years 1885 to 1890 inclusive, the average annual rate of mortality from all causes was 12·6 per 1,000, and in 1890 it was only 11·2 per 1,000.

The County Borough of Preston.

Delegates to the Congress.

Councillor HOLDEN, J.P.
Councillor J. E. DUNN.
H. O. PILKINGTON, M.R.C.S., Medical Officer of Health.

Preston is one of the oldest and most important of the manufacturing towns of Lancashire. It is picturesquely situated on the northern bank of the valley of the Ribble, the centre of the town rising to an elevation of 150 feet above sea level; and it is distant some 15 miles from the Irish Sea. It has an area of 3,721 acres, and, according to the recent census, a population of 107,864.

Many historical associations are connected with it, dating back to the time of the Roman occupation, and it was when the neighbouring town of Ribchester began to decline in importance as a Roman station that Preston is first heard of. In 1648 it formed the battle ground between Cromwell and the Royalist forces, and it played an important part in the Jacobite risings of 1715 and 1745. The town was occupied by Prince Charles Edward in the course of his march to, and retreat from, Derby; while Hoghton Tower in the immediate neighbourhood is celebrated in connexion with the memorable visit of King James I., and the elevation of the loin of beef to the honours of knighthood.

By Royal Charter the town enjoys the right to hold a Guild Merchant, a period of public celebration and rejoicing, first commenced about the 12th century, and regularly held every 20 years since 1542. The last guild was held in 1882, when Mr. Alderman Edmund Birley filled the honoured rôle of Guild Mayor.

The town possesses many fine buildings, and is especially remarkable for its handsome churches; chief amongst these is the Roman Catholic Church of St. Walburgh's, the graceful spire of which, with its surmounting vane, rises to a height of 333 feet, the highest erected since the period of the Reformation.

The town hall is a handsome Gothic structure built in 1862–67 by Sir G. G. Scott, the clock tower and spire being 197 feet in height. Adjoining it, and now rapidly approaching completion, is the Free Public Library and Museum, taking its name from the late E. R. Harris, Esq., the munificent donor of this and other gifts to his native town. To this building will shortly be transferred a very choice collection of pictures valued at 60,000*l.*, left to the town by the late Richard Newsham, Esq., and at present occupying a portion of the Guild Hall. The reference library, bequeathed and endowed by Dr. Shepherd in 1759, and the collection of valuable and interesting objects forming the museum, at present temporarily located in Cross Street, will also find a suitable location in this magnificent building.

Preston is an important centre of railway traffic, and possesses a handsome station, one of the finest to be found in provincial towns,

erected at a cost of 250,000*l.*, and opened in 1880. It is also a large and increasing centre of postal communication, occupying, as it does, a position on the main artery between the north and the south, and being in direct communication with the whole of East Lancashire, and the important district known as the Fylde on the West. It has an efficient system of tramways, leading to the suburbs of Ashton and Ribbleton, and to the adjoining township of Fulwood. These were commenced in 1879, and enlarged in 1882.

The Ribble Navigation scheme, commenced by the Corporation in 1883, is now rapidly approaching completion.

For recreation purposes the people of Preston have the advantage of several handsome parks. Of these, two—the Avenham and Miller Parks—extend along the banks of the River Ribble; the third, named the Moor Park, is of considerable extent, and is situated towards the northern side of the town.

The Miller Park is about 11 acres in extent, and the land was a gift to the town by the late Alderman T. Miller, "subject to the payment "by the Corporation of the sum of 40*l.* a year, to be applied for a "University Exhibition in connexion with Preston Grammar School." It contains a handsome statue to the late Lord Derby, erected by public subscription at a cost of 2,500*l.*

The water supply is abundant and of good quality, and is derived from moorland gathering grounds, distant about 20 miles from the town. The waterworks were first established in 1832, and came into the hands of the Corporation about the year 1853. Since then extensions and improvements have been carried out, both as regards the area of collection and the facilities for storage, and still further ones are contemplated.

Following upon the formation of a sanitary committee and the appointment of a medical officer of health in 1874, much has been done to improve the public health and the sanitary condition of the town. In the first place steps were directed towards the closing of a number of unhealthy houses and cellar dwellings, and to the opening out of others built on the back-to-back system. Latterly the attention of the authority has been mainly directed towards improving the closet accommodation, and in a large number of cases the watercloset and movable ashpail has been substituted for the previously existing privy and large offensive ashpit. Additional powers in this direction were obtained by the Improvement Act of 1880, in which also was inserted a clause requiring the compulsory notification of infectious disease. At the present time large works are in progress by which the sewage of the town, instead of being discharged, as now, into the river, will be conveyed in iron pipes to Freckleton, distant about six miles in the seaward direction, where a farm of some 600 acres, recently purchased by the Corporation, will be available for dealing with it. Another destructor, for treating the dry ashes and other refuse, is also being erected at the pumping station to supplement that which has been for many years in use at the other end of the town.

The Borough of Richmond.

BY

Councillor T. F. WAKEFIELD.

Delegates to the Congress.

JNO. T. ROWLAND, M.D., &c., Medical Officer of Health of the Richmond Urban Sanitary Authority.

Councillor T. F. WAKEFIELD, Chairman of Health Committee.

Richmond is beautifully situated on the banks of the Thames, and is surrounded by parks and open spaces. On the high ground on the south side of the town is Richmond Park, eight miles in circumference, and comprising 2,253 acres; whilst on the slope of the hill is Petersham Park; and in the vale below Sudbrook Park. Towards the north are the Old Deer Park, and the Royal Gardens at Kew. On the South-west is the famous view from the terrace on Richmond Hill unsurpassed in the world for its sylvan beauty. The view, with the river in the immediate foreground, extends to Windsor Castle which can be plainly seen in the distance on the one side, and to Hind Head near the village of Haslemere, Surrey, 35 miles distant, on the other.

The attractiveness of the Terrace has been greatly enhanced by the purchase of the gardens on the slope of the hill (formerly belonging to the Duke of Buccleuch) at a cost to the town of 15,000*l.* The cost of maintenance is about 700*l.* a year.

Richmond was governed by a vestry under a special Act of Parliament passed in the year 1785 until the town was incorporated by Royal Charter in 1890. Sir J. Whittaker Ellis, Bart., M.P., a former Lord Mayor of London, and a native of the town, was the first Mayor.

The area of the borough is 1,256 acres, of which 557 is Crown land, viz., part of Richmond Park, 67 acres, the Old Deer Park, 353 acres, and part of Kew Gardens, 137 acres. Application has been made for an extension of the boundaries, which will double the area of the Borough.

The population according to the last census in 1891 was 22,684 as compared with 19,066 in 1881. In 1801 when the first census was taken the numbers were 4,628. The increase at the close of each decennium has been as follows: 1811—591; 1821—775; 1831—1,249; 1841—509; 1851—1,503; 1861—1,666; 1871—4,187; 1881—3,956; 1891—3,618.

The rateable value of the borough is now (1891) 180,000*l.*, and the number of inhabited houses 4,300. The number of burgesses on the roll is 3,397.

The total income of the borough in 1890 was 57,400*l.*, and the loan indebtedness 136,386*l.*

The water supply, at one time taken from the river Thames, afterwards from the Southwark and Vauxhall Water Company, whose mains run through Richmond, is now derived from: 1. An artesian well, near the river, 1,146 feet deep. 2. A well in the Terrace Gardens down to the chalk, 470 feet deep. 3. A well in the Petersham Meadows, supplied by springs. The supply from the wells is as yet insufficient, and is supplemented by water drawn from the mains of the Southwark and Vauxhall Company.

The supply is about 477,700 gallons per diem, which, for a population of 23,000, gives less than 21 gallons per head for all purposes. The average supply by the Metropolitan Water Companies for 1889 was for domestic purposes 23·93 gallons per head per day, and for all purposes 29·91 gallons.

An adit is now being driven through the water-bearing chalk from well No. 2 to join well No. 1, and it is hoped that eventually an adequate

supply will thus be obtained. The cost of the plant, &c., has been 77,000*l.* The annual income is 10,000*l.*, of which 5,000*l.* goes to pay off the loan (originally) of 75,000*l.* and 5,000*l.* to pay annual expenses. The water rate is 1*s.* 4*d.* in the £.

Richmond has hitherto been drained into the Thames, but a system of drainage works for the town and adjoining districts has just been completed at a cost of 100,000*l.*, by which the sewage is conveyed to filtering tanks located by the banks of the Thames below Kew Bridge, about two miles distant from the town. The effluent passes into the river. The sewers are well ventilated, and the Holman-Keeling Sewer Gas Destructors are used. It is expected that Richmond will shortly become one of the best drained towns in the kingdom. Typhoid fever and diphtheria are practically extinct in the district.

The River Thames is at once a source of recreation and of health to the inhabitants and visitors to Richmond; but since the embankment of the Thames, the rebuilding of the bridges below with greater waterway, and the dredging away of shoals, combined with the increased intake of the water companies above Teddington Lock for the supply of London, the level of low water in the Thames at Richmond has been gradually falling; the low-water level at Richmond Bridge has fallen 4 feet since the bridge was built in 1774.

In accordance with an Act of Parliament obtained in 1890, a footbridge, lock, and weir are now being constructed below Richmond, which will hold up the water at ebb tide and thus ensure above this point a reasonable depth of water. The shallows will thus be covered, and boating will be possible at all times of the tide. The cost is estimated at 45,000*l.* or more, of which Richmond is to pay 25,000*l.*

The Thames Conservators have contributed to the cost, and are now building the lock and bridge which will be of peculiar construction with sluices (Stoney's) worked on steel rollers, placed in recesses in the piers of the bridge; these, although of enormous weight, can be lifted and lowered with the greatest facility, and when raised can even be canted up under the footway of the bridge so as to be out of sight.

Public baths were erected in 1882 at a cost of 10,000*l.*; and a free public library, partly supported by a voluntary rate. Much attention is paid to sanitation, and the death-rate in 1889 was as low as 13·0 per 1,000 against 17·5 for London. In 1890 (an exceptional year) it was 14·6 against 20·3 for London.

Richmond is practically a suburb of London; the rateable value is high in proportion to the population, and the inhabitants are of a class who interest themselves in sanitary matters.

As an urban sanitary authority Richmond has a medical officer of health, and an inspector of nuisances with an assistant inspector. There is also a sanitary association composed of medical men and others who make it their business to see that the Public Health Act and Sanitary Acts are enforced. Richmond has a hospital, but no separate hospital as yet for the isolation of infectious diseases. The Surrey County Council propose to deal with the county as a whole in this matter.

The Terrace Gardens, the Grove Road Pleasure Ground, the Lower Mortlake Road Recreation Ground, and the Green, a large space of ground on which cricket is played, furnish to the inhabitants extensive areas for recreation; and the riverside footpaths provide delightful walks.

Richmond Green belongs to the Crown and was formerly the Tilting Yard of the Old Palace, portions of which are still remaining. There still exists an old Tudor gateway with a room above in which Queen Elizabeth is said to have died.

Cholmondeley Walk by the riverside is under the control of the Corporation and is a favourite resort of the inhabitants.

Richmond is distant from London Bridge, by the river, 26 miles; from Lincoln's Inn Hall, by road, 11 miles; and by rail from Waterloo Station, 9¾ miles.

The Borough of Ryde.

Delegate to the Congress.

FRANCIS NEWMAN, Borough Engineer and Surveyor.

The borough of Ryde is situate on the south shore of the Solent Sea, and on the north side of the Isle of Wight. The Isle of Wight, although an administrative county under the Local Government Act of 1888, is part of the county commonly known as "Hampshire," but in legal language as the "County of Southampton."

The pier head at Ryde is five miles from the Portsmouth Harbour Pier of the London and South-Western and London Brighton and South Coast Railway Companies; and 2¾ miles from the Stokes Bay Pier of the London and South-Western Railway Company. The area comprised within the boundaries of the borough, exclusive of foreshore covered at high water, is 801 acres.

The geological character of the Isle of Wight is very varied; a ridge of chalk extends from east to west through the centre of the Island, with its dip-slope to the northward; north of this the soil consists of the clays and other beds of the tertiary system, and southward of chalk and greensand. Ryde is, therefore, situate on the tertiary beds, but being on a hill with bold slopes to the north and east, water is not retained on its surface.

At the commencement of the present century Ryde consisted of two villages called Upper and Lower Ryde; very early in the century they were united by the formation of the present principal business street, called Union Street. The foreshore at Ryde, uncovered at low water, is about three-eighths of a mile in breadth, and consists of clay now wholly covered by a deposit of sand; formerly it was covered for only about 100 yards from high-water mark outwards with sand and gravel. It thus formed an obstacle to communication by sea, excepting at high water, and to remedy this a company was formed which obtained parliamentary powers in 1813 for the construction and maintenance of a pier, and for supplying water for shipping. The construction of the pier was at once proceeded with; it has been subsequently widened and extended to about half a mile in length, and the head increased in size.

From this period the population rapidly incrased, and towards the close of the third decade of the century had so grown as to induce the inhabitants to seek the powers of local government then only granted to towns by special Acts of Parliament, but now happily more perfectly and inexpensively obtained, by the adoption of the Public Health Act. Accordingly, in 1829 was passed "An Act for paving, watching, lighting, "cleansing, and otherwise improving the Town of Ryde, in the Isle of "Wight, in the County of Southampton, and for establishing a market "within the said town." This Act gave power for paving footways in the streets, for watering the carriageways, and for scavenging the

streets; but left the repair of highways, that is the carriageways of the streets, in the hands of the Commissioners of Highways for the Isle of Wight. In 1847 an Act was obtained vesting the repair of the highways in the town in the Ryde Commissioners. By the Act of 1829 the Commissioners appointed were the Governor and Captain-General of the Isle of Wight, and every person who should be possessed in his own right, or in the right of his wife, of real or personal estate in a messuage or tenement, messuages or tenements, land, tithes, or hereditaments in the town, which should be of the value, above all charges, of 1,000*l.* and who should make an oath or affirmation to that effect. The Commissioners erected a town hall and market house, and caused the footways to be paved, and other improvements to be made; they also caused the footways and streets to be properly cleansed and watered. But until 1847 no sewerage work of a systematic character were executed. At that time, although Ryde was to some extent a water-closeted town, the waterclosets all drained into cesspools, the overflow drains from which passed into drains carried under the streets by different owners. The owners abutting on the shore, or on the watercourse in the valley, on the eastern side of the town, having taken their drains to the shore, or to the watercourse, the owners immediately above them drained into the upper ends of these drains; and the next owners joined the upper ends of the last; while in parts of the town situated on beds of sand or gravel, very little drainage had been attempted; but about 1847, some brick sewers were put into the streets by the Commissioners.

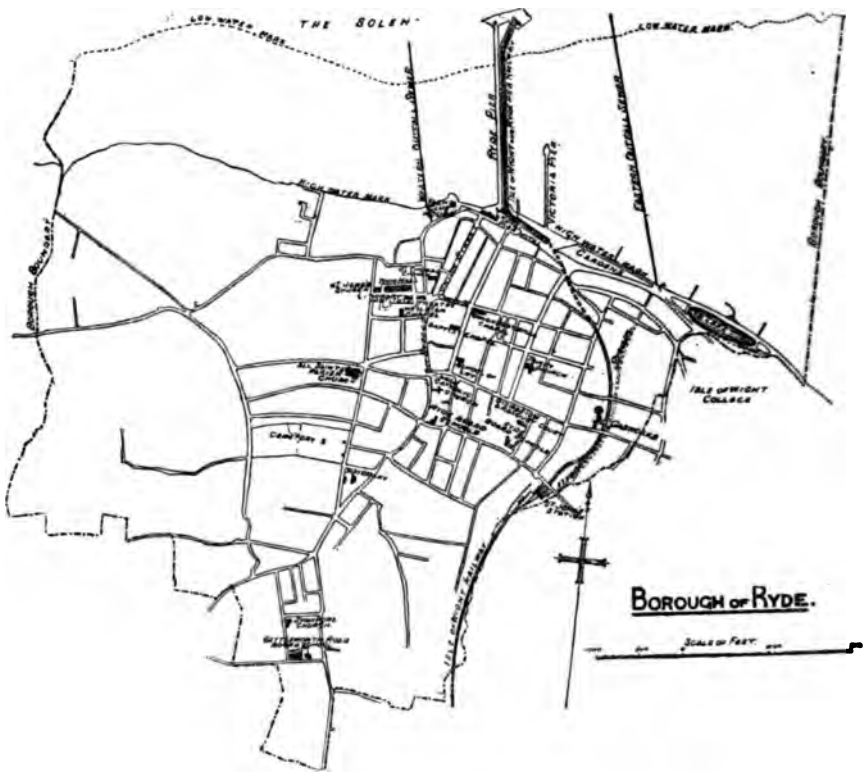
In 1849, during the visitation of cholera, Ryde suffered severely. Between 1849 and 1852 other sewers were laid down in a fragmentary way; and an important intercepting sewer was laid to take the drainage discharging on the shore and convey it by means of an elm trunk across the foreshore, to a distance of 700 feet below high-water mark.

Still no systematic scheme of sewerage had been attempted, and the sewage, discharging on the foreshore, was partly returned at flood tide. At that time the public supply of water was limited to three or four public wells and the waterworks constructed by the Pier Company for the supply of shipping. These had been leased to a private individual, and were used by him to supply houses, for which purpose mains had been laid in many of the streets, but the supply available for this purpose was very insufficient.

To meet these defects, in the year 1852 a movement was made for the adoption of the "Public Health Act, 1848," the promoters seeking amongst other improvements, a complete system of sewerage; an improved water supply; an extended boundary; the construction of an esplanade next the sea; and an elected board.

The opposition to the adoption of the Act was, however, so strenuous that the General Board of Health did not proceed with the Order. In 1853, the promoters of the adoption of the Public Health Act and many of the leading opponents of that step, came to an understanding to promote a local Act having the above-named objects in view; which Act, after some some opposition, and some concession to those outside

1 p. 1855.



the former boundary but included in the proposed boundary, was passed in 1854. The Act vested the government of the town in 27 commissioners, one-third of which were to be elected annually.

In 1868 a Charter of Incorporation was obtained, the number of aldermen being fixed at six, and that of the councillors at 18; and shortly afterwards the commissioners transferred their powers and liabilities to the town council. A separate commission of the peace was shortly after granted, and at the same time a separate police force was established for the borough.

The Local Government and Public Health Acts having been adopted, the administration of the Borough is now in harmony with the great majority of the urban districts of England.

Since 1854 the sewerage of the town has been rendered complete, the sewers generally being of stoneware pipes, the main trunk sewers of brick; two iron outfall sewers have been carried across the foreshore, discharging at points where there is a depth of six feet of water at low spring tides. The sewers are efficiently ventilated, and provided with inspection chambers. All cesspools have been abolished, the house drains have been connected with the sewers, and in nearly the whole of the town defective or obsolete private sanitary arrangements have given place to the most modern appliances.

The old waterworks were acquired by the commissioners; a pumping station and reservoir erected on the north slope of Ashey Down, three miles to the southward of the town, with the view of supplying water from the chalk; and a complete system of mains laid down. The supply at Ashey not being sufficient, another pumping station was erected at Knighton to the southward of Ashey Down, from which water is now obtained from the chalk and upper and lower greensands, of the greatest purity and in ample quantity, and a constant supply is given to all consumers.

An esplanade has been formed along the whole of the front of the town eastward of the pier, with gardens 15 acres in extent abutting on the sea, including a lake, three acres in extent, for canoes, small pleasure boats for children and model yacht races.

Large additions have been made to the town hall, which now contains a room seating 800 persons, a second room communicating therewith which will seat nearly half that number, a justice room, council chamber, committee rooms, public offices, and several smaller rooms with good approaches and other conveniences.

In 1872 a wooden Isolation Hospital for infectious diseases was built; this has since been removed to a more eligible site and improved. The accommodation provided in this building has been found greatly in excess of the requirements on each of the few occasions on which this hospital has been needed, during the 19 years of its existence.

The Burial Acts were adopted by the Commissioners in 1861, and a cemetery constructed; this has since been extended and now contains an area of 9 acres.

The population of the old town in 1831, two years after the passing of the first Improvement Act, was 3,396, and in 1881, 50 years later, 11,461.

The length of streets and roads being carriageways in the borough is $16\frac{7}{8}$ miles; the length of flagged footways at the sides of such streets is $17\frac{1}{2}$ miles, and the length of curbed, channelled, and gravelled footways is $5\frac{1}{8}$ miles. The length of sewers is $15\frac{1}{2}$ miles.

Excepting in the business streets there are very few houses in the borough built in rows; they are for the most part detached or semi-detached with gardens. Even the great majority of the houses of the working classes built during the last 40 years are in pairs, with side entrances and small gardens back and front.

The borough supplies water and provides outfall drainage for the suburbs of St. John's and Haylands, situate outside the boundary and containing a population of upwards of 3,000.

The amount of outstanding debts of the Corporation secured by mortgages on the rates is 96,000*l.*, of which 42,500*l.* is in respect of the waterworks.

The rate of mortality in the borough for the year 1890, which was in excess of some recent years, was 15·27 per thousand.

In the preceding paragraphs the leading improvements effected by the governing body of the town are enumerated; but public and private

enterprise in other directions, have contributed to make the town a pleasant health resort and a desirable residential locality.

The Royal Isle of Wight Infirmary and County Hospital, which is available as a medical and surgical hospital for the whole of the inhabitants of the island, was erected in 1849, and has since been considerably enlarged.

Handsome churches and chapels have been built as well as good elementary schools, voluntary or controlled by the school board. There are also good private schools for the children of those of larger means, which with the Isle of Wight College, founded in the immediate neighbourhood in 1880, the Ryde Young Men's Christian Association, and the Literary and Scientific Institute, and the Ryde School of Science and Art give to the town exceptional educational advantages.

Gasworks were established by a company in 1839. Railway communication has been made with other parts of the island, and connected with the sea by a railway pier, adjacent to the old Ryde Pier, at the side of which an electric railway runs for local traffic.

Excellent sea bathing is provided at the Victoria Pier, with medicated and other sea baths. There is also a public bathing stage available for men and boys at a charge of a halfpenny each, which is extensively used.

The exceptional advantages of the Solent for yachting, which have always been recognised, led to the formation at Ryde in 1845 of the Royal Victoria Yacht Club, and in 1846 a large and well appointed club house was built, and for many years Ryde has been one of the principal English yachting stations.

The Borough of St. Helens, Lancashire.

The County Borough of St. Helens (Lancashire) is situate 11 miles east of Liverpool and 21 west of Manchester. It is a rapidly increasing and important manufacturing town of comparatively recent date, having received its charter of incorporation in 1868. Depending as the borough does for its importance on its various manufactures, it may be said to date from the establishment in 1773 of the Ravenhead Plate Glass Works, which are historically interesting by reason of their being the first of the kind established in Britain, the manufacture having been introduced by La Bruyere from Picardy.

The present area of the borough is 6,558 acres, and its rateable value is 273,621*l.*

The borough comprises the whole of the Townships of Sutton and Parr, and portions of the Townships of Windle and Eccleston; those portions of the two townships outside the borough being mainly of a rural character.

The population of the whole of the four townships was in 1801, 7,573; in 1811, 9,397; in 1821, 10,603; in 1831, 14,194; in 1841, 21,450; in 1851, 28,042; in 1861, 41,345; in 1871, 49,034; in 1881, 61,472; and in 1891, 77,076; while the population of the borough in the censuses taken since its incorporation was ascertained to be in 1871, 45,134; in 1881, 57,403; and in 1891, 71,288.

The great factors in the production of its commercial prosperity are its geological formation and its railway and canal accommodation. By its situation on the southernmost limit of the Lancashire Coal Measures, its manufacturers have secured an abundant supply of good coal. Ample railway and canal accommodation were provided at an early period, and such accommodation now forms part of the L. & N.W. Railway Company's system. The Sankey Canal running from St. Helens to the River Mersey,—the oldest canal in the British Isles, dating from 1755,—connects St. Helens with the sea.

St. Helens is the chief seat of the manufacture of plate and crown glass in Great Britain, if not in the world; one firm alone employing over 4,000 men in its manufacture. Along with the neighbouring town of Widnes, it is also the principal seat of the chemical trade in England; the combined towns manufacturing three fourths of the heavy chemicals made in Great Britain. The more important substances made are caustic soda and potash, carbonate of soda and potash, hydrochloric and sulphuric acids, sulphate of magnesia soda and ammonium, chlorate of potash, and soda. There are several very extensive copper works and glass bottle works, also potteries, chemical manure works, lead, silver, and nickel works, besides numerous collieries.

Owing to its rapidly increasing population, and the extensive area covered by the town, it has been found necessary from time to time to apply to Parliament for powers for dealing with sanitary and other requirements. The first Act, incorporating the St. Helens Improvement

Commissioners and giving them power over parts of the Townships of Windle, Eccleston, and Parr, was passed in 1845. By a subsequent Act passed in 1851 the limits under the jurisdiction of the Commissioners were extended, and in 1863 and 1865 local government boards were established for the Township of Sutton and for the part of Parr not within the Commissioners' limits. In 1868 the whole of these districts with some additions were incorporated as the Borough of St. Helen's, and ample powers for the government of the whole borough were conferred by the St. Helen's Improvement Act, 1869.

Since that time, new streets and passages have been laid out at an expense of 120,000*l.* All the streets, with the exception of a few of those made before 1845, are laid out with "back passages" of 4 or 9 feet wide for the convenience of sanitary measures.

Extensive sewerage operations have been undertaken at a cost of 45,000*l.* to convey the sewage rapidly from the precincts of the town, instead of allowing it to flow into a small and sluggish stream which meanders through the town, and which acts at present as the main sewer and drain from the various works; and large sums of money are now being spent on the completion of these operations. The removal of excreta is carried out on the dry system. Many of the old privy-ashpits still exist, but are being converted, as they fall into disrepair, into tub and pail closets. All the most approved methods of working the tub and pail system have been here adopted.

Two well laid out public parks, with areas of 36 and 12 acres respectively, have been established. Two sets of public baths are maintained by the Corporation, the more recent of the two having been lately erected at a cost of 10,083*l.*, and provided with all the latest improvements as to structure, size, and management. This set of baths contains a men's swimming bath of 101 feet by 30 feet, a ladies' bath, 40 feet by 25 feet, two vapour baths, and 39 private baths.

Two general medical and surgical hospitals, each doing good work, exist; the one being supported by voluntary subscription and endowment, the other mainly supported on the penny-a-week system from the employées of works—a system which is found to supply ample means for its maintenance. The Corporation have also provided a free isolation hospital for infectious diseases, in which good and useful work is being done.

A small gravitation waterworks existed at the time of the passing of the first St. Helens Improvement Act in 1845; the Commissioners arranged for the transfer to them of the powers possessed by the company owning these works, and under Acts passed in 1851 and 1855 made large additions to the water supply, which was further increased by the Corporation under their Acts of 1869 and 1882; so that there is now a supply of 3,000,000 gallons a day, or about 40 gallons per head of the population supplied, half of this probably being used for manufacturing purposes. The total cost of the works has been over 171,000*l.*, and the water rate at present is 4⅜ per cent. on the gross rental of the house for domestic purposes, and 5*d.* per 1,000 gallons per meter for manufacturing purposes.

The gasworks were purchased by the Corporation in 1879 at a cost of 140,000*l.* At that time 111,800,000 cubic feet of gas were manufactured per annum. At the present time the works stand in the books at 172,000*l.*, and are sending out annually 203,503,400 cubic feet of 18½ candle power gas at the price (subject to discounts for quantities of over 20,000 cubic feet) of 2*s.* 9*d.* within the borough and of 3*s.* 3*d.* without the borough; the area of supply being considerably larger than that of the borough itself. Meters are supplied to consumers without charge.

The foundation stone of very handsome new municipal buildings was laid in 1873, and the work was completed in 1876. The buildings comprise a large and well-decorated assembly room, a fine council chamber, committee rooms, extensive municipal offices, a free public library, police station and offices, and a court-room.

The free public library, which was established and is maintained under the local Act, is not dependent on the penny in the pound rate of the Free Libraries Act, although the expense has, as a matter of fact, been kept within that limit; it contains 18,000 volumes in its lending and reference departments. There are well-appointed separate reading rooms for general readers, for ladies, and for boys. As compared with similar institutions in neighbouring towns, there is an exceptionally good use made of the books in all departments of literature. There are also two branch libraries in the outlying districts of the borough in connexion with this central one.

The County Borough of Salford.

BY

CHARLES E. PAGET, Medical Officer of Health.

Delegates to the Congress.

Alderman B. ROBINSON, Mayor.
Alderman A. L. DICKINS, J.P.
C. E. PAGET, M.R.C.S., L.R.C.P., D.P.H.

The county borough of Salford is a large town lying N.N.W. to, in part adjoining, and in part separated by the River Irwell from, the city of Manchester. The borough comprises three principal townships, viz., Salford, Pendleton, and Broughton. The former of these townships is the most important commercially, and certainly contains the most ancient property of the borough; a large portion of the Pendleton and Broughton townships is residential, though both townships also contain large mills and manufactories.

The total area of the borough is 5,170 acres, and is made up in the following township proportions: Salford, 1,329 acres; Pendleton, 2,415 acres; and Broughton, 1,426 acres.

The borough of Salford received its Charter of Incorporation in the year 1844, but before that time it was a free borough under a Charter of Ranulph, Earl of Chester and Lincoln, apparently in or about the year 1231. The Council at the present time consists of 64 members, of whom 16 are aldermen and 48 are councillors.

The population in the year 1831 was 52,366, and is now estimated to be 198,717. The rateable value of the borough is 782,158*l.*

An Act passed in 1862 extended the powers of the corporation.

An Act was obtained in 1857 for burial purposes, and in that year the cemetery was opened. In 1888 it was extended to double its original size.

Under the Salford Improvement Act of 1871 the corporation has carried out an extensive scheme for the disposal of the sewage and for its purification.

The intercepting sewer provides for carrying the whole of the sewage of the borough to the sewage works. It varies in size from 2 feet 6 inches by 2 feet 6 inches at the commencement to 8 feet by 7 feet at the outfall, It is over 8 miles in length, and cost upwards of 115,000*l.* The sewage works were opened in 1882. There is a pumping plant for raising the sewage to the level of the precipitation tanks, and the purified sewage then runs into the River Irwell. At present the sewage is being treated with lime, but, in view of the approaching completion of the Manchester Ship Canal, the corporation intend to abandon this process, and are experimenting to discover some process which will fulfil the requirements of the Rivers Pollution Prevention Act. The cost of the sewage works, including land, tanks, and machinery, was upwards of 84,000*l.*

The length of main sewers in the borough is over 160 miles, in addition to the main intercepting sewer.

The streets of the borough are paved and sewered, and the passages drained and flagged.

The total length of streets declared highways is over 120 miles.

The water supply is from the reservoirs of the Manchester Corporation.

The gas works are vested in the Corporation. In 1890 the Corporation obtained a Provisional Order for supplying the borough with the electric light.

In 1875 the Corporation obtained powers under which they have laid an extensive system of tramways, and, in 1885, powers to lay further new lines, as well as to authorise the use on the lines of steam, electric, or other motive power. There are 6¼ miles of double lines, and 8½ miles of single lines.

Extensive street improvements have been carried out from time to time. The Blackfriars Street Improvement, begun in 1871, was the means of demolishing a large number of small houses and cellar dwellings in the district of Greengate.

A large block of property, consisting of very insanitary dwellings, called Birtle's Square, was demolished in 1881, and the site has since been sold for warehouses.

A Local Government Board inquiry was held in March 1891 with reference to certain blocks of property, on which representations had been officially made by the medical officer of health under the Housing of the Working Classes Act, 1890, and negotiations for dealing with the premises are now in progress.

The area of these blocks is about 21,447 square yards, and the population to be displaced is about 1,450. The death-rates of these areas varied from 40·8 to 78·2 per 1,000 of the persons living in them. The Corporation is taking steps for the provision of a model common lodging house for the accommodation of a portion of the population which will be displaced by the demolition of the insanitary property.

The borough is well supplied with pleasure grounds. There are four parks, namely Peel Park, Seedley Park, Albert Park, Ordsall Park, comprising altogether about 100 acres. There are besides seven recreation grounds containing a total area of about 26 acres.

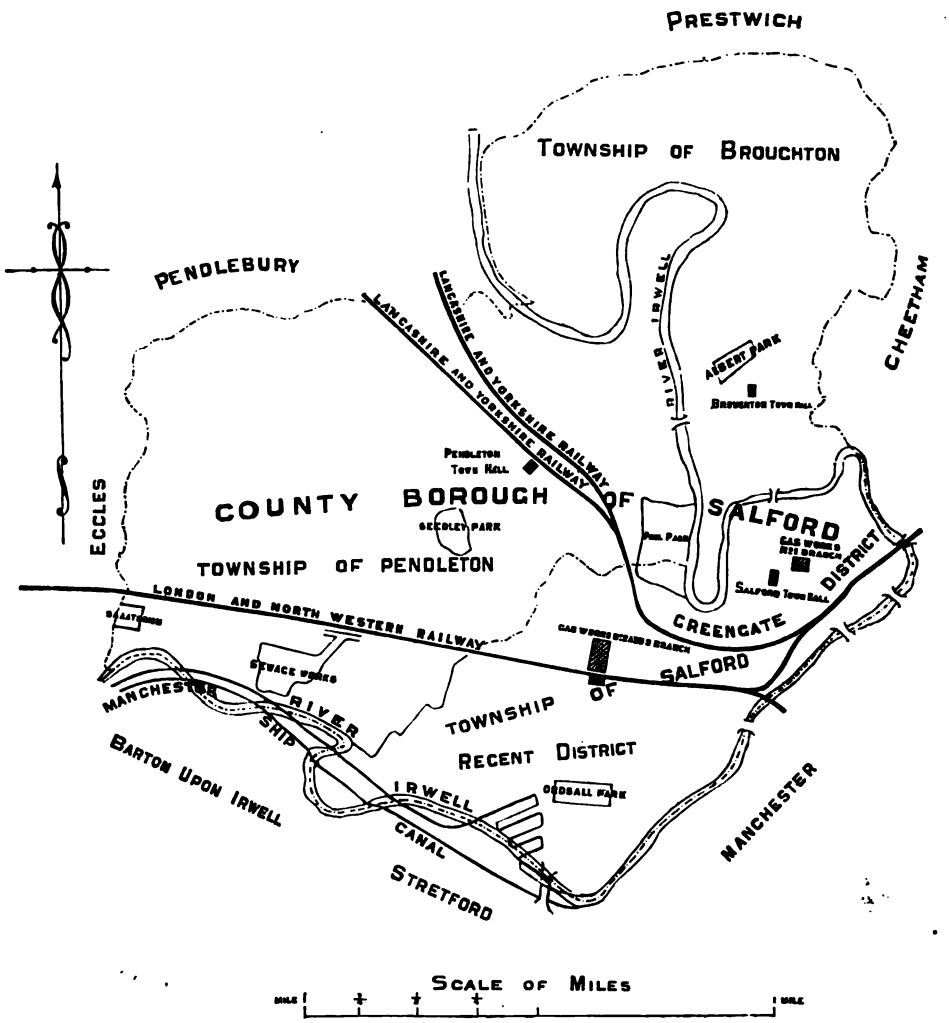
There are five public Free Libraries in the borough.

Two public baths have been established at a cost of 21,514*l.*, and two others of equal size are now in course of erection.

A hospital for infectious diseases was opened in 1876. A new hospital, to accommodate 184 beds, with 2,000 cubic feet of space per bed, is approaching completion. The land for this new hospital cost 13,101*l.*, and the buildings are estimated to cost 32,170*l.*

There is a large general hospital and dispensary, called the Salford Royal Hospital, in the Salford township, with a branch dispensary in the Pendleton township.

COUNTY BOROUGH OF SALFORD



The Notification of infectious diseases has been in force in the borough since the year 1883, under a local Act passed in 1882, but the general Act of 1889 is now in operation.

There are several charities in Salford, the principal one being the "Booth's Charity" for old people who have lived in the Salford township. Humphrey Booth the elder's Charity, was founded in 1630, and Humphrey Booth the grandson's Charity in 1695.

The income is derived from chief rent of land in Manchester and Salford, and from Government stock, and exceeds 9,600*l.* per annum. It is disposed of to about 550 recipients in sums varying from 5*s.* to 10*s.* weekly.

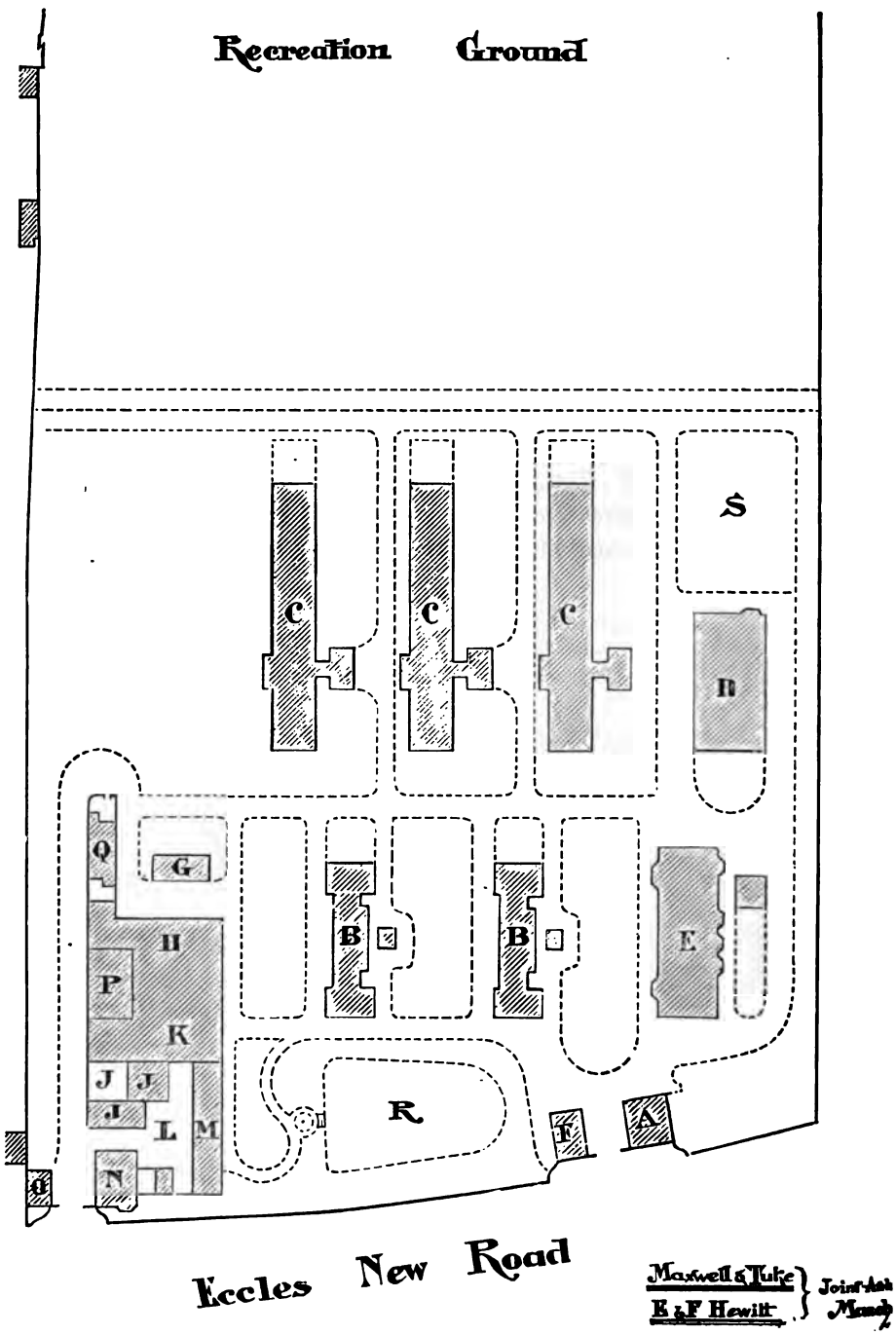
During the year ending March 25, 1891, 906 blankets, 100 counterpanes, 723 pairs of sheets, 1,322 yards of calico, 20 pieces of flannel, 365 yards of Melton cloth, 247 yards of Wincey, 53 shawls, and 16 pairs of shoes were distributed amongst the poor.

The blankets, &c., are stamped to prevent their being pawned, and special notices are sent to pawnbrokers at the time of each distribution.

In 1845 the Police force numbered 45 men; there is now a force of 330, including a chief constable, a deputy chief constable, one superintendent, and 13 inspectors.

A separate court of Quarter Sessions was granted to the borough in 1889.

SALFORD SANATORIUM.



SALFORD SANATORIUM.

Reference to Plan.

A.—Lodge and office, and single men-servants' lodgings.
BB.—16 isolation wards to accommodate 40 patients.
CCC.—Pavilions. Total accommodation for 144 patients, with nurses' day-rooms, and offices.
D.—Kitchens, stores, and servants' residence.
E.—Residence of medical superintendent, matron, and nurses
F.—Discharging rooms, with bath room, and waiting rooms for parents or friends.
G.—Fuel.
H.—Patients' and staff laundries.
J.—Yard, van sheds, hearse, and ambulance.
K.—Disinfecting station for the borough.
L.—Yard.
M.—Stable, carriage-house, and harness-room.
N.—Lodge office for sanitary station.
O.—Mourners' room.
P.—Boiler-house.
Q.—Post-mortem room and mortuary.
R.—Nurses' recreation ground.
S.—Servants' recreation ground.

The Borough of Wallingford, Berks.

Delegates to the Congress.

HENRY HAWKINS, Mayor.
FRANCIS E. HEDGES, Town Clerk.

Wallingford, with a present population of 2,989, is an ancient fortified town on the banks of the Thames, surrounded by the river and a moat and earthworks; the greater part of the latter are still in existence. It was created a borough in the time of Edward the Confessor, and received Charters from Henry I. and Charles II. It formerly returned two members to Parliament until the Reform Act, 1832; and afterwards one, until its disenfranchisement in 1885. It is now included in the parliamentary division of North Berks.

The Corporation secured in 1884 an unfailing supply of excellent water which may be used free of cost for domestic purposes. The water is pumped by Otto gas engines from a deep tube well to a tower 60 feet in height. The water is of great purity, and remarkably free from hardness.

Drainage works are upon the point of being finished. Wallingford being flat and undrainable by gravitation only, the Shone hydro-pneumatic system has been adopted. By this system, ordinary gravitation drainage is taken advantage of as far as possible; but where, owing to the flatness of the district to be drained, ordinary gravitation cannot be resorted to without laying the sewers at great depths, recourse is had to mechanical power. The Shone system of distributing compressed-air power, from one air-compressing station, to as many ejector stations (which are the equivalents of so many pumping stations) as are required, to secure effective gravitation drainage to each station, meets the case at Wallingford admirably.

The municipal area of Wallingford is 404 acres; but the habitable areas are confined to the eastern, or Thames side. These habitable areas, for the sake of securing good gradients for the gravitation sewers, have been divided into three drainage districts. No. 1 contains 43 acres, No. 2, 30 acres, and No. 3, 93 acres. In each district there is an ejector station furnished with two ejectors of 100 gallons each. The positions of these ejector stations are shown on the accompanying outline plan of Wallingford, drawn to a scale of 6 inches to a mile. The position of the air-compressing station is also shown on the plan referred to. From the compressing station the compressed air is delivered to the ejectors in each station, through small cast-iron pipes, laid under the streets, and as the ejectors are automatic, they require very little attention. The two Atkinson "Cycle" gas engine air-compressors employed are also automatic, so that this system of rapidly collecting and ejecting sewage requires the very minimum of attention.

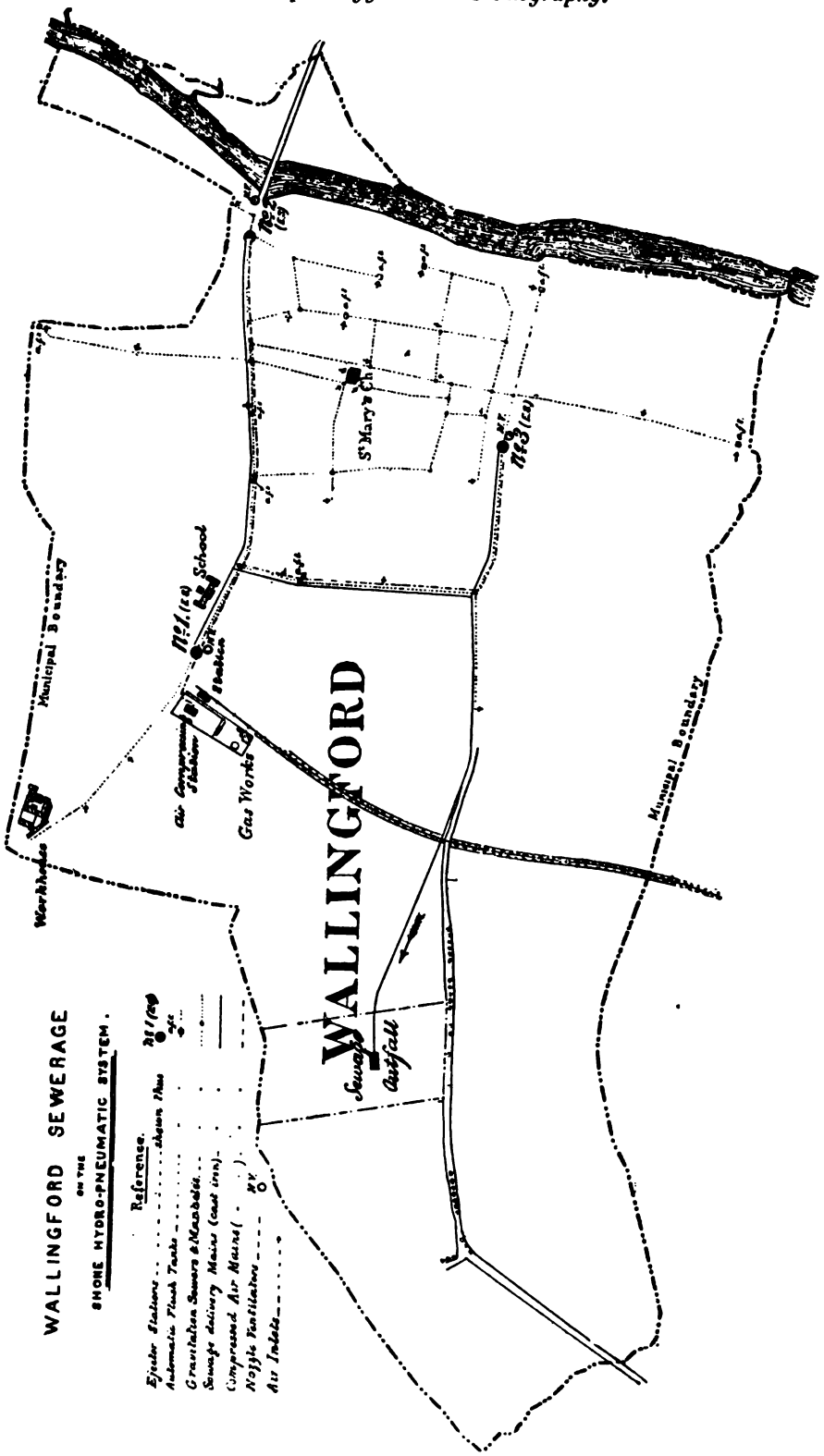
There are nine automatic flush tanks at the heads of the main sewers. All the manholes on the line of the main sewers have hermetically closed covers. Fresh air is admitted into the main sewers through stand-pipes

erected at intervals on the lines of the sewers. The admission of the fresh air takes place at the tops of the inlet stand-pipes which are 7 feet above the level of the streets, and the efflux of the air takes place at the tops of ventilating stand-pipes or shafts 30 feet above the level of the street. These ventilating stand-pipes or shafts are erected in such situations near to the ejector stations as are convenient and suitable for the purpose. Fresh air is drawn into the main sewers through the several air inlets by a more or less powerful vacuum action, produced by pneumatic nozzle ventilators, placed at, or near to, the base of the efflux stand-pipes. The vacuum is created by the action of the exhaust air from the ejectors passing through the nozzles.

The velocity at which the exhaust air proceeds from the ejectors when they are being filled with sewage is sufficiently great, when it is escaping to the efflux ventilating pipe through the nozzle, to induce an extraneous current to follow it, and this latter proceeds from the sewers, having been drawn therein from the atmosphere through the various inlet ventilating pipes.

The induced current of air from the sewers is greatest when the charge of compressed air—after it has done its work in expelling the sewage—is escaping from the ejectors. The action of the induced current may be likened to the action of the water tank discharging its contents suddenly and rapidly into the sewers to flush them.

The Wallingford sewers will thus be flushed with water and with air; and by reason of the comparative steepness of the gradients at which the main collecting sewers pipes are laid throughout the entire system, they will be, or ought to be, rendered permanently self-cleansing; because under such conditions foul air charged with sewage gas cannot be produced within them. The sewage is to be ejected from the three ejector stations through iron sealed pipes on to 10 acres of land outside the town, specially prepared for its utilization and purification. Just as fast or as slow as the sewage is delivered, while fresh and harmless, into the ejectors, so fast, or so slow, will it be delivered in the like condition into an automatic discharging tank of 3,000 gallons capacity at the outfall. At the inflow end of the automatic tank the sewage is screened from its solid accompaniments, and the time occupied in filling this tank will be sufficiently long to permit of a fairly good deposition of the suspended matters, so that when the tank is discharged its contents will be largely freed from those constituents which have a tendency to choke up the pores of the soil in the filtration area on to which it will flow. Moreover the filtration area is divided into beds, which are so arranged that one charge of the tank will only be enough to irrigate, to a moderate extent, one bed at a time. After the whole contents of the tank have been discharged onto a bed the sewage will gradually percolate into the soil, and before a second discharge can take place the first will have been partially if not wholly absorbed; the land now prepared for its reception being very suitable for the purification of sewage by intermittent subsidence in the manner described.


WALLINGFORD SEWERAGE
ON THE
SHORE HYDRO-PNEUMATIC SYSTEM.
Reference.
Ejector Stations
Automatic Flush Tanks
Gravitation Sewers & Manholes
Sewage delivery Mains (cast iron)
Compressed Air Mains
Nozzle Ventilators
Air Inlets
WALLINGFORD
Sewage outfall
Municipal Boundary
Municipal Boundary
Gas Works
Air Compressing Station
Workhouse
School
St Mary's Ch.

The corporation have been informed that their drainage and water system are more satisfactory than any in existence. Be this as it may, the sanitary condition of Wallingford leaves little to be desired. The sewerage works were designed and carried out by Messrs. Shone and Ault, of Great George Street, Westminster.

The death-rate is only 15·3 per thousand, and it is hoped that under the improved sanitary conditions it may be still further reduced.

The subsoil is composed of gravel and sand throughout, as has been proved during the recent excavations for drainage purposes, and to this fact must be attributed the high standard of health which the town has always preserved.

A market is held here on every Friday. The corporation consists of a mayor, four aldermen, and twelve councillors.

The town hall, *temp.* Charles II., an erection upon massive pillars, is very quaint. It contains portraits by Gainsborough, Sir Thomas Lawrence, G. D. Leslie, R.A., James Hayllar, and others. There is an excellent cottage hospital, a public bathing place, a free library, and three churches, of which the old church of St. Leonard is a very perfect specimen of Norman architecture. The grounds of Wallingford Castle are full of interest, and the neighbourhood is pretty.

The County Borough of Wolverhampton.

Delegates to the Congress.

Alderman JACKSON, F.R.C.S., J.P.
Alderman J. C. MAJOR, J.P.

Wolverhampton is a Parliamentary and Municipal Borough of West Staffordshire, and also a County Borough under the Local Government (England and Wales) Act, 1888.

So long ago as A.D. 659, Wulfere, first Christian King of Mercia, established a monastery here, but of this no vestiges remain; and nothing further is known of Wolverhampton until 996, when Wulfruna, widow of the Duke of Northampton, founded a church dedicated to the Virgin (now St. Peter's, or as it is more familiarly called "the Old Church"). This church was accounted one of the King's free chapels, and was annexed by Edward IV. to the Deanery of Windsor.

Little improvement occurred after this date until the reign of Henry III., when that Monarch, on the 4th February 1258, granted a charter for a market to be holden here on every Wednesday, and a fair to be kept annually for eight days, commencing on the vigil of the Feast of St. Peter and St. Paul. The next public event of importance was the erection of the Free Grammar School, which was founded by Stephen Jennyns in 1515; at this school Congreve and Abernethy were educated. The school, one of the most useful of the many public institutions of which the town can boast, is now carried on in a new and imposing building situate in a most pleasant part of the town.

Up to the 54th year of the reign of George III. the only local authority having jurisdiction over the town appears to have been a county magistrate appointed for the district; but in that year an Act was passed for its better government by commissioners. A Court of Request was about the same time established for the recovery of sums under 5*l.*

In recent times the town has rapidly increased in population, wealth, and enlightenment, and is now the largest manufacturing town in the county, being known as the "Metropolis of the Black Country."

The town was enfranchised by the Reform Act of 1832, and was allotted two members. By the Redistribution of Seats Act, 1885, the Parliamentary Borough of Wolverhampton was accorded the privilege of returning three members of Parliament.

The population of the Municipal Borough at the present time is 82,600.

The area is 3,440 acres, and the rateable value 270,125*l.*

Wolverhampton was first incorporated as a Municipal Borough in 1848.

In the year 1850 by Provisional Order confirmed by Act of Parliament, the Public Health Act, 1848, except a small portion thereof, was applied to the borough.

By the Wolverhampton Improvement Act, 1853, provision was made for the improvement, regulation, and cleansing of the borough, and for the maintenance and regulation of the markets and fairs thereon, and for other purposes.

The Corporation, which acts as the Urban Sanitary Authority, consists of 12 aldermen and 36 councillors, presided over by the mayor.

The borough has a Commission of the Peace (the first granted on the 27th July 1849), and a separate Court of Quarter Sessions granted on the 6th May 1864. It possesses also a separate police force, consisting of one chief constable, one superintendent, four inspectors, 12 sergeants, and 62 constables. There is also an efficient fire-brigade.

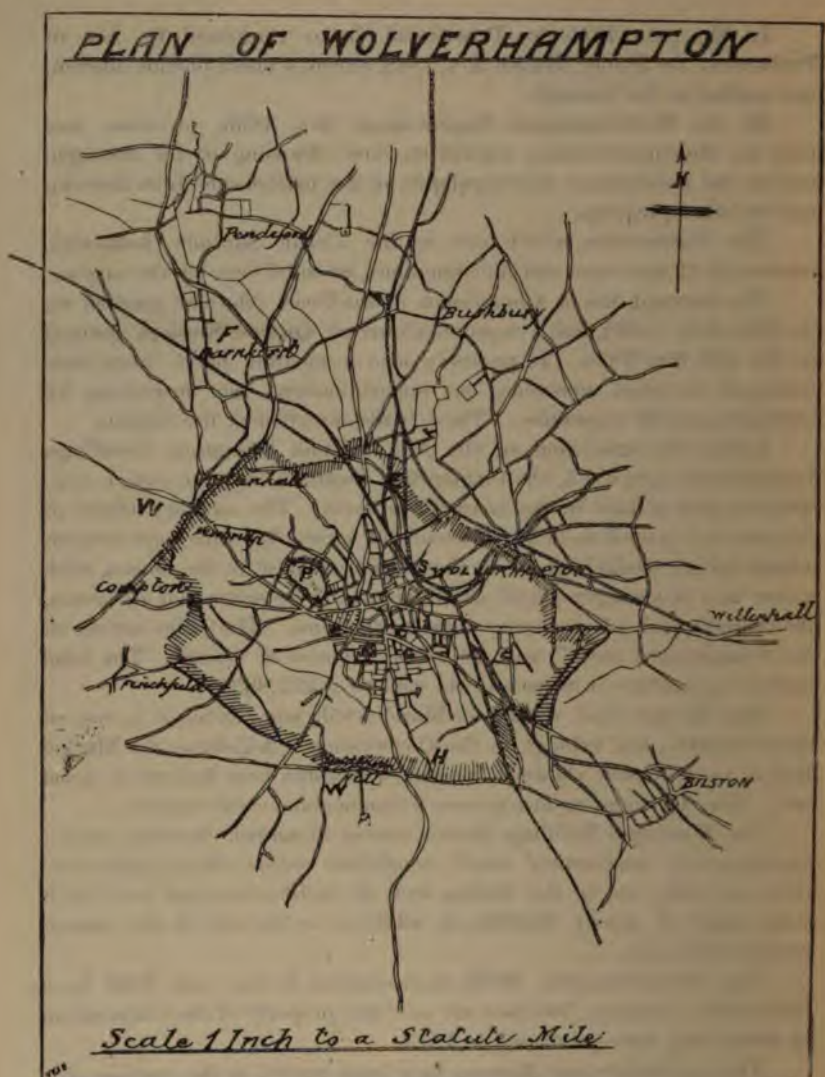
Under the provisions of the Artizans and Labourers Dwellings Improvement Act, 1875, the Corporation acquired, at great cost, a considerable area of land in the heart of the town. The sanitary defects of this area being such as to be irremediable except by some improvement scheme which would lead to the demolition of most of the houses, with a view to a re-arrangement of dwellings and a reconstruction of streets, the Council took all necessary steps to that end. The entire extent of the "condemned area" was 16 acres, inclusive of streets. The total capital expenditure in respect of the scheme is 217,862*l.*

The Market Hall, opened in March 1853, was erected at a cost of about 30,000*l.*, and belongs to the Corporation. Adjoining the Market Hall is an extensive wholesale market, which has been laid out at great cost. The Corporation also possess a commodious cattle market.

The Municipal Buildings (which consist of council chamber, quarter sessions court, magistrates' court, committee rooms, offices, police barracks and cells) are in the Italian style of architecture, and were built at an outlay of nearly 20,000*l.*, in addition to the cost of the greater portion of the site.

The Wolverhampton Baths were erected in the year 1860 by a Joint Stock Company, but they are now the property of the Corporation by whom they were purchased in 1875.

The Art Gallery and Museum have been erected at the expense of a generous burgess upon land appropriated for that purpose by the Corporation. The buildings are of Bath stone in the classic style and the façades exhibit two orders of architecture, the Doric being employed for the ground-floor storey, and the Ionic for the storey above. The ground floor is devoted to the museum, and the upper storey to the picture galleries; the front of this storey and the side facing St. Peter's Church is filled in with sculptured panels in Portland Stone containing emblematic figures in bold relief by Doulton, representing painting, sculpture, and science. Mrs. Maria Christian Cartwright (widow of the late Mr. Sidney Cartwright, a burgess of Wolverhampton) by her will, dated 18th August 1883, bequeathed a valuable collection of pictures to the Corporation. Many other choice pictures and works of art have been gratuitously provided for the gallery, and donations have



INDEX TO PLAN.

C.—Churches.
H.—Infectious Hospital.
W.—Pumping Stations (Wolverhampton Waterworks).
F.—Sewerage Farm and Outfall Works.
T.—Town Hall.
P.—Public Park.
S.—Railway Station.
E.—Fox's Lane Depôt, Night Soil Department.

also been given towards the purchase of other requisities for the same institution.

Upon land appropriated by the Corporation and adjoining the gallery of art, a building has been erected for a school of science and art by means of funds raised by voluntary subscriptions aided by a grant from the Science and Art Department. By the generosity of a deceased townsman a scholarship has been founded in connexion with this institution.

The Municipal Free Library comprises libraries, lecture hall, museum, science class-rooms, and a reading room. There are about 32,000 volumes in the library, including a reference library of 5,633 volumes and a lending library. In connexion with this Institution chemical and metallurgical laboratories have been established.

The rate authorised to be levied under the Public Libraries Act, 1855, being insufficient to defray the expenses necessary for the proper carrying on and maintenance of the Free Library and the Gallery of Art and School of Science and Art, the Corporation obtained powers in the Wolverhampton Corporation Act, 1887, to levy an additional rate of one penny in the pound.

A public park, covering an area of 50 acres, forms one of the most pleasing features of the town, and has been laid out at a cost of 16,000*l.* The property is held upon lease from the Duke of Cleveland for a period of 63 years from the 25th March 1879, with right of pre-emption at the expiration of that term.

In 1869 the Corporation obtained an Act for defining and extending their powers in relation to the management of streets and to sewerage and to police, and other matters of local government, as well as to water supply and for other purposes. This Act was amended by Provisional Order (confirmed by Act of Parliament in 1888), whereby additional powers were conferred upon the Corporation in relation to the public park, new buildings, hackney carriages, and financial matters. In 1882 the Corporation were empowered by Act of Parliament to exercise their statutory borrowing powers for the time being by means of the creation and issue of Corporation Stock.

Under the authority of the Act of 1869 an important sewage scheme was formulated and carried into effect. The Sewage Farm, consisting of 330 acres and th outfall works are situate outside the borough. The total cost of the whole scheme is estimated at upwards of 182,000*l.* Great difficulties have been occasioned in regard to the utilisation of the sewage of the borough by reason chiefly of the geographical situation and the physical altitude of the district, the large volume of the effluent to be carried off and the small capacity of the stream into which it is discharged; special relief was, therefore, extended to the Corporation by the Wolverhampton Corporation Act, 1891.

In 1867 the Corporation acquired the control of the water supply of the borough and of certain adjoining districts by transfer from a waterworks company. The water delivered for consumption is, according to analysis, of unusually good quality, superior, in fact, in organic purity to generality of town supplies, not even excepting that obtained by

Glasgow from Loch Katrine. Part of the supply is derived from springs in the red sandstone rock at Tettenhall and Goldthorn Hill, where there are storage reservoirs; the one at Tettenhall is capable of holding 14,000,000, and that at Goldthorn Hill 1,500,000 gallons. The principal supply of water, however, is obtained from an Artesian well at Cosford, near Shifnal (Salop), about 10 miles from Wolverhampton, where the Corporation have a commodious pumping station and a very costly and efficient plant. The daily average consumption of water for all purposes amount to upwards of 3,250,000 gallons.

The Corporation have erected a hospital for the treatment of infectious diseases capable of accommodating about 60 patients. The cost of this building has been about 4,000*l.*

The total number of streets and roads is 370, and their total length 68 miles. They are all lighted and well maintained.

The Corporation have also adopted the Notification of Disease Act, the Infectious Disease (Prevention) Act, and the Public Health Acts Amendment Act.

The gasworks, tramways, and cemetery belong to private companies.

From the foregoing sketch of the municipal history of this borough, it will be observed that Wolverhampton does not fall short of other large towns in its desire to uphold and carry into effect, as far as possible, the principles of local government, whereby the moral, physical, social, and intellectual welfare of its inhabitants may be secured.

The Sanitation of the City of Ahmedabad, in the Bombay Presidency.

BY

RUNCHORELAL CHOTALALL, President of the Ahmedabad Municipality.

The city of Ahmedabad is situated in north latitude 23° 1′ and east longitude 72° 37′, on the left bank of the Saburmattee River, about 173 feet above mean sea-level, and 50 miles north of the Gulf of Cambay. The area within the city walls is about two square miles, and contains a population of 124,716 according to the latest census, that of 1891. The jurisdiction of the Ahmedabad municipality extends to the suburbs situated beyond the city walls, the population of which is 18,948, making the total municipal population 143,664 in 1891. The population by the previous census, that of 1881, was 127,210. There are seven cotton mills in Ahmedabad and its neighbourhood, which attract persons from the surrounding districts, and hence the more than normal increase in population. The average rainfall is about 30 inches, and it generally rains during the four months from June to September; the remaining eight months are the fair season.

The soil on which the city of Ahmedabad stands is a very light sandy loam, very porous and dry. The average level of the subsoil water in a fair season stands about 23 feet below the general level of the city.

With such a dry and naturally healthy soil, and such a favourable condition of the movement of subsoil water, Ahmedabad should be a very healthy city, but, owing to the absence of proper sanitation, it has had the misfortune of showing a very heavy mortality.

There being no drainage system for the removal of liquid filth, all the impurities are being soaked into the soil or evaporated in the streets. For the disposal of sewage and other filthy liquid, a system of cesspools, called "khalcoovas," prevails in Ahmedabad. A "khalcoova" is in construction like a dry well. On a wooden kerb a steining of bricks is built dry without mortar in the joints, so that water may easily find its way through it, and this brick cylinder is sunk to within a few feet of the subsoil water-level. The top of this well, about five feet below ground-level, is arched over with a brick and mortar dome; a connexion with the house drain being made, earth is filled in over the dome. All the sullage water of the house is run off into the "khalcoova"—all the bathing water, the kitchen water, the urine, the washings of the privies, and every conceivable liquid filth. All the liquid thrown into this khalcoova or cesspool filters through the sandy soil at the bottom and sides and finds its way into the subsoil water, and thus these khalcoovas are kept in working order, without opening and cleaning out, for more than 30 or 40 years. But the result of the system has been that water of all the wells in the city is so much

polluted as to be quite unfit for drinking. Most of the wells in the city are so badly affected by these khalcoovas that their water is too brackish to be drinkable in any form whatever; however, this water is freely used for washing, bathing, and all other domestic purposes.

But there are some wells in the city, the water of which is not very badly affected, and is, therefore, used for drinking by the people, though under chemical analysis it shows unmistakeable signs of dangerous sewage pollutions.

It will, therefore, be seen that while the water of all the wells outside the city is good for drinking, the wells in the city are so polluted by the objectionable system of khalcoovas that the water therefrom is totally unfit for this purpose. The present system of disposing of the sewage in Ahmedabad is such as to pollute the earth, water, and air, and the result is that the death-rate of Ahmedabad is almost the heaviest in the Bombay Presidency.

From time immemorial there existed a system of deep-well privies in Ahmedabad into which the solid night-soil was collected within the house itself. These privies were also built on the same principle as khalcoovas, with the exception that they were not arched over and were inside the house. They, too, were not cleansed for years, because the owners managed to throw some quantity of salt into the privies to reduce the solid excreta to a liquid state, so that it might soak out through the bottom and sides. The effluvium arising from these well-privies found its way into the house, and was necessarily mixed with the air breathed by the inmates of the house. The nuisance of these deep-well privies was so horrible that on the representation of the Sanitary Commissioner these privies were closed and filled up in the years 1878–79 and 1879–80, and open privies, which could be cleansed daily, were substituted, and the change was followed by a perceptibly good effect.

There exist returns of the mortality in Ahmedabad for 17 years since 1874, and I have appended a statement showing the population, the total of deaths, and the ratio of deaths per 1,000 of population. I have divided the time into three periods. The first period is of six years, from 1874–75 to 1879–80, when the system of deep-well privies was in existence, and it will be seen that the average death rate of this period was 54·75 per 1,000 of population per annum. The second period of six years, from 1880–81 to 1885–86, is one when all the human excreta from the city were removed and deposited half a mile from the city, and the result has been that the death-rate was reduced to 44·74 per 1,000. But in 1886 the Municipality thought it proper to remove the night-soil depôts from the vicinity of the city to a distance of about three miles in a leeward direction, by laying down a tramway, worked by animal power, and to have the night-soil converted into poudrette to be used as manure; and the result in this third and last period of five years, from 1886–87 to 1890–91, is that the average death rate has been 40·43. The average would have been somewhat less had it not been for the unusual epidemic of influenza in the year 1889–90.

I am glad to state that since the introduction of the system of local self-government, good progress is being made with the assistance and encouragement of Government in the sanitary improvement of Ahmedabad. A line of tramway exists for the removal of night soil, as stated above; and a sufficient supply of water is now an accomplished fact, the new waterworks (the water of which is pronounced by the chemical analyst to be very good) having been opened on the 11th of June 1891, and it is hoped that this will lead to great improvement in the health of the town.

The most important subject of drainage, by which the abominable system of khalcoovas can be done away with, is now under immediate consideration. The Municipality has obtained the advice of the distinguished sanitary expert, Mr. Baldwin Latham, towards draining a portion of the city, and it is hoped that in the course of a year the experiment will be made, which may lead to further extension.

Ahmedabad is not the only city the sanitary condition of which requires to be improved. There are hundreds and thousands of towns in India where the same objectionable system of deep-well privies, and khalcoovas (cesspits), and impure water-supply prevail; but if Government and the municipalities will only do what is necessary, the general death-rate can be so reduced as to save hundreds of thousands of human lives every year.

APPENDIX.

A Return showing Variations in the Death Rate of the City of Ahmedabad in connexion with the disposal of Night-Soil.

No.	Year.	Population.	Deaths.	Ratio of Deaths per Thousand.	Remarks.
1	1874-75	120,318	5,305	44·09	In this period the system of deep-well privies was in existence.
2	1875-76	121,467	6,604	54·36	
3	1876-77	122,615	6,274	51·17	
4	1877-78	123,764	5,585	45·12	
5	1878-79	124,912	8,452	67·66	
6	1879-80	126,061	8,253	65·47	
		739,137	40,473	54·75	
	Average -	—	6,745	—	
1	1880-81	127,210	5,430	42·69	In this period the filth removed from the city was kept in its vicinity.
2	1881-82	128,855	6,825	52·96	
3	1882-83	130,500	5,061	38·78	
4	1883-84	132,146	5,090	38·52	
5	1884-85	133,791	6,123	45·76	
6	1885-86	135,437	6,729	49·68	
		787,939	35,258	44·74	
	Average -	—	5,876	—	
1	1886-87	137,082	4,497	32·81	In this period night-soil depôts were removed at a distance of three miles in a leeward direction.
2	1887-88	138,727	4,719	34·01	
3	1888-89	140,373	6,805	48·48	
4	1889-90	142,018	7,140	50·28	
5	1890-91	143,664	5,217	36·32	
		701,864	28,378	40·43	
	Average -	—	5,675	—	

The City of Bombay.

Delegate:

E. C. K. Ollivant, C.I.E.

The city of Bombay is situated on the western shore of India. Formerly at high tide it was a collection of islets, and at low tide a pestilential swamp studded with eminences. But by the judicious construction of embankments and breakwaters to shut out the sea (the first of which, viz., Hornby Vellard, was constructed during the period 1771 to 1784, during the time of Governor Horaby) and by the construction of roads across what had hitherto been marsh land (the first of which, Grant Road, was built in 1835), and by the gradual reclamation of the low-lying lands, the sea was excluded, and the islets united together at their bases, and thus a mass of land was formed containing an area slightly in excess of 22 square miles. It is an island, or rather a peninsula, connected with the mainland by two causeways and two lines of railway.

The population of Bombay, estimated to be 10,000 in 1662, had increased to 16,000 in 1716. In 1816 the population was 221,550, which had again increased to 810,000 in 1891.

A writer 200 years ago, when describing Bombay, states "the "unhealthiness of the water bore a just proportion to the scarcity and "meanness of the diet," and then adds, "out of every 500 Europeans "who came to live on the island, not 100 left it." Thirty-two years ago 70 deaths in a day from cholera was not an uncommon occurrence. At that date Bombay was dependent for its water-supply on the local wells and tanks, and the average annual number of deaths from cholera alone was returned at 2,241. On the introduction, however, of water from the Vehar Lake, the average was immediately reduced to 507, and in proportion as that supply has become generally adopted a still further reduction has taken place, the return of deaths by cholera for 1890 being 102. "Guinea worm," which was a common complaint in Bombay, commenced to disappear with the improvement in the water supply, and is now almost unknown.

The city is at present supplied with water from two artificial lakes, viz., Vehar and Tulsi, situated in the island of Salsette, distant about 10 miles north of Bombay. These two lakes, with the necessary service reservoirs in the city cost about Rs. 1,15,00,000 (1,150,000*l.* at 2*s.* the rupee). A third lake has been constructed at Tansa, 55 miles away from the city, which, with the duct which is nearly complete, will cost about 1,500,000*l.*, taking the rupee at 2*s.* The Tansa Lake is the largest of the three, having an area of 5½ square miles, and a watershed of 52·50 square miles. It is expected to be completed, with all its accessory works, in March 1892, and is the most costly municipal work yet undertaken in India, while the masonry dam which impounds the water is believed to be the largest in the world. These three lakes will

supply the city with 32,750,000 gallons of water per diem at an average pressure of 100 feet, which, for a population of 810,000, equals about 40 gallons per head per day. The Tansa Lake is capable of supplying a much larger quantity, which can be made use of when the time comes by adding to the capacity of the duct.

Extensive drainage works have been, and are still being, carried out, and up to date nearly 55·33 miles of sewers have been laid at a cost of Rs. 40,96,561 (496,560*l.*). The main principle on which the sewerage works have been designed is to secure segregation of storm-water from the sewage, a necessity consequent upon the concentration of the annual rainfall within a short period of the year, and on the inability to construct channels to do the dual duty of sewers and drains under the variable condition of flow during the dry and wet seasons. Before the new works were commenced, the city was drained by flat-bottomed masonry drains, many of vast dimensions, which received both storm-water and sewage, and which during fair weather became merely elongated cesspools. Under the present project, the main sewers, both masonry and pipe sewers, have been constructed on the most approved and modern principles of sanitation. The sewerage works when completed will cost probably not less than 1,000,000*l.*

As the greater proportion of the thickly populated area of the city is hemmed in on two sides by ridges of high land, the storm-water falling on the inward slope of the latter, and gravitating to that portion of the city which is flat and below high water mark, used to flood it to a very serious extent.

In order to prevent this, large intercepting drains for a length of 5·21 miles have been recently constructed, to cut off the low-lying from the high level district and to carry away the storm-water falling on the latter directly to the sea. The Municipal Corporation obtained last year from Europe the services of the eminent sanitary engineer, Mr. Baldwin Latham, to report and advise on the drainage and sewerage of the city.

Since the passing of the Municipal Act of 1872 special attention has been paid to the maintenance of roads, and to the construction of new roads. The road surface invariably consists of at least 6 inches of macadamised trap rock laid on 6 inches of rubble packing of the same material. Many new roads have been constructed of late years, and many more have been recently sanctioned, especially for the purpose of developing the northern portion of the island, to meet the ever-increasing demand for building land.

The total length of public roads is 142·57 miles, and the total length of private roads is 36·50 miles. The total area of the public roads is 3,674,138 square yards, and that of private roads is 1,599,459 square yards. The total area of paved footpath is 124,354 square yards. The greater portion of the city is lighted with gaslights, and the northern or suburban portion of the city is lighted with kerosine oil lights. There are 3,600 gas lamps, and 1,512 kerosine oil lamps in the city.

Prior to 1872 most of the public streets were narrow and crooked. Since then many of them have been much improved by taking up land on either side whenever opportunity offered, and by throwing the land so taken up into them. This process, however, is slow and expensive, and the old streets in the thickly-peopled portion of the city leave much to be desired. .

Several public markets have been provided in the city, of which the Arthur Crawford Market is the most extensive and the most imposing, having an almost world-wide reputation. An extensive abattoir has also been constructed at the northernmost verge of and without the city, where all animals intended for food are slaughtered and dressed for the market before being sent into Bombay. Here also the carcasses are subjected to inspection, and to rejection if found in any way unfit for human food, while the joints are again inspected on arriving at the market.

There are nine public gardens in the city, having a joint area of 179 acres. In the largest of them, the Victoria Gardens, a small zoological collection is maintained.

There are 11 hospitals, to one of which, viz., the Jamsetjee Jeejeebhoy Hospital, the chief medical school of the Presidency, viz., the Grant Medical College, is attached. An asylum and hospital for lepers was erected last year by public subscription, and contains now more than 240 lepers.

The city, forming as it does the terminus of two of the most important railways in India, viz., the Bombay, Baroda, and Central India Railway, and the Great Indian Peninsula Railway, with its magnificent harbour, affording unlimited protection to shipping of any burthen lying in mid-stream, and also safe and convenient landing at its several wharves and docks (especially the Prince's and the Victoria Docks), has become the chief emporium of trade in India. The average total trade per annum, both export and import, amounted to Rs. 1,38,00,000 at the commencement of the 19th century, and had increased to Rs. 83,18,66,426, or nearly 60-fold, in the year 1889.

Statistical Summary.

Population, 1891, 810,000.

Average death-rate per 1,000 for the last five years, 24·55.

Maximum temperature of air, 100°·20; mean temperature of air, 79°·13; minimum temperature of air, 53°·30; average annual rainfall from 1843 to 1889, 70·97 inches.

Maximum daily rainfall (6th June 1886), 16·10″; maximum hourly rainfall (12th June 1847), 4·22″.

Length of public roads, 142·57 miles; length of private roads, 36·50 miles; area of public roads, 3,674,138 square yards; area of private roads, 1,599,459 square yards; area of paved footpath 124,354 square yards.

Number of gaslights, 3,600; number of kerosine oil lights, 1,512.

Length of brick and pipe sewers, 55·33 miles.

Annual municipal revenue, Rs. 53,42,170; rate of taxation per head (consolidated) $15\frac{3}{4}$% on the gross annual rental minus 10%.

Rateable value of properties in Bombay, Rs. 2,73,64,359; number of buildings, 33,106.

Area of Tansa Lake, 5,713 acres; area of gathering ground for Tansa Lake, 33,600 acres.

Area of Vehar Lake, 1,400 acres; area of gathering ground for Vehar, 3,900 acres.

Area of Tulsi Lake, 331 acres; area of gathering ground for Tulsi, 1,714 acres.

Water-supply per head when Tansa Lake is finished, 40 gallons.

Number of fire brigade stations, 9; number of steam fire engines, 7; number of manual engines, 7.

Tram lines (double track), 10·27 miles; tram lines (single track), 7 miles.

Number of public gardens, 9, with an area of 52 acres.

Value of important public buildings, Rs. 1,50,00,000; steam roller for roads, 20; spinning and weaving mills, 69; presses, 6.

Sanitary Improvements in the City of Calcutta.

BY

H. J. S. COTTON, B.C.S., Secretary to the Government of Bengal, Delegate from the Corporation of Calcutta.

The underground drainage system of Calcutta was commenced in 1859. The total expenditure incurred on the work up to the 31st March 1890 is about 110 lakhs of rupees.

The number of premises connected with the sewers is 25,938. There are 37 miles of main or brick sewers, and 147 miles of pipe sewers. The enormous improvement effected by the obliteration of the old open drains—an elongated cesspool, as they have been called—and the substitution of underground drainage in their place, can only be appreciated by those who remember Calcutta in former days; but it may still be partially realised by a visit to the suburbs of the town, where open drains still exist. A survey for the systematic drainage of the suburbs is now in progress.

The total capital sunk in the Calcutta Water Works is, in round numbers, Rs. 1,42,72,000, of which nearly half has been spent on extensions of the original scheme. This outlay has been amply repaid, not only by the improved health of the inhabitants, but also by the increase of wealth and material prosperity which the reputation for good drinking water has attracted to the city. It was officially stated in November last that there were 990 standposts on the filtered, and 2,565 ground hydrants on the unfiltered system. The number of house ferule connexions was 16,321. The daily supply had then reached an average of 35·4 gallons of filtered water, and 8·9 gallons of unfiltered water per head of the population. The filtered water is of the highest possible quality of purity.

The roadway of the town has been augmented during the past 12 years by about 10 per cent., and the area of roads watered by 33 per cent. The lighting of the town has increased from 3,41[illegible] lamps to 4,[illegible]92. The quantity of refuse removed from the town has more than doubled, having increased from about 80,000 to more than 200,000 tons. About 240 impure and insanitary tanks have been filled up, and tanks other than those in private enclosures are now very rare in any part of the town, except the extreme north. In the place of tanks, the town has been studded with 86 bathing platforms for the use of the poorer inhabitants. Six public squares have been constructed and laid out at considerable expense, to the great advantage of the people living in the neighbourhood. Organised measures have been adopted for the removal of lunatics,* at a cost of more than 10 lakhs of rupees.

It was observed by one of the late health officers of Calcutta, in a published address, that "Calcutta has, to right and wrong, [illegible]

* Cases of lunacy received by the police [illegible]

memory, undergone a revolution"; and it may be added that during the past 12 years the changes effected have been more rapid and decisive than in the 20 years which preceded them. Dividing these years into three quadrennial periods, it is found that, during the first of these periods, the total number of deaths was 62,226, during the second 49,863, and during the third 45,793. But the improvement is most marked in its effect upon the wealth of the town. It is stated to be, on the whole, a very moderate estimate that, while the population has practically remained stationary, the value of land has more than doubled since 1878, and that the increased value to the owners is about nine crores of rupees. It would be difficult to produce a more decisive tribute to the wisdom of sanitation.

The present recorded death-rate of Calcutta varies from 25 to 30 per thousand. These statistics, however, place the public health of Calcutta in a fictitiously favourable light. The population is largely an immigrant one, and more than half consists of individuals who are in the full vigour of manhood and womanhood, the majority of whom, when they become seriously ill, leave Calcutta for their homes. On the other hand, it is usual among persons of the respectable and middle classes, when they are old or ill, to come into Calcutta on account of its superior sanitary attractions, and for medical attendance. But while the death-rate cannot be accepted as an absolute test of the health of the city, the statistics do enable a comparison to be made of the mortality in different years; and it is highly interesting to notice the great diminution in the number of deaths from such principal diseases as cholera and fever since the drainage works have been constructed, a pure water-supply given, and other sanitary improvements set on foot.

The mortality from cholera in Calcutta has been carefully registered for the past 50 years, and the average annual number of deaths from this cause during each of the five decades is as follows:—

1840 to 1889.	Average Annual No. of Deaths.
First decade, 1840 to 1849 - - - - -	4,818
Second decade, 1850 to 1859 - - - -	4,261
Third decade, 1860 to 1869 - - - - -	4,747
Fourth decade, 1870 to 1879 - - - -	1,327
Fifth decade, 1880 to 1889 - - - - -	1,640

There is, no doubt, a marked periodicity in the mortality from cholera, which seems to point to some biological law in the life-history of cholera contagion. The synchronous rise and fall of cholera in Calcutta and in the neighbouring districts of Bengal is of almost invariable occurrence. Calcutta is affected by causes not peculiar to itself, but common to all the neighbouring localities, and although the incidence of mortality is now low in Calcutta in consequence of the extensive sanitary works which have been undertaken, a more or less corresponding ratio continues to exist between Calcutta and the adjoining

populations. It is owing to this periodic intensity of an epidemic wave of cholera, more than to any other cause, that the average number of deaths during the 10 years from 1880 to 1889 exceeds the average of the previous decade. During 1882, 1883, and 1884, there was a violent outburst of cholera, not in Calcutta only, but throughout the neighbouring districts. It is also true that during the 30 years which preceded the introduction of a pure water-supply, *i.e.*, before 1870, there was a similar periodicity in the cholera death-rate: but during that period the lowest annual number of deaths was 2,268 (in 1867) and 2,502 (in 1848), and the highest was 6,826 (in 1866), 6,553 (in 1860), and 6,427 (in 1846), whereas after the introduction of the water-supply the lowest annual death total has been 796 (in 1871) and 805 (in 1880), and the highest 2,272 (in 1884). Generally speaking, therefore, it may be said that during the last 20 years, when a pure water-supply has been available, the cholera mortality is only one-third of what it was in former times. It may be admitted, as an eminent authority, Dr. J. M. Cuningham, has pointed out, that the fall in cholera mortality in 1870 was partly due to other causes, and that it was pronounced before one drop of water reached the city: but, be this as it may, the comparative average immunity which has persistently prevailed since 1870 can only be explained by attributing it to the improved water-supply which dates from that year. The change which has taken place in Calcutta in regard to cholera is indeed extraordinary, and sanitarians may well appeal to the evidence of these figures as demonstrating with mathematical certainty that sanitary reform, and, above all, the supply of pure water, is the only effectual method for controlling this terrible disease.

With equal confidence may they point to the statistics of the mortality from fever. The following statement, which is derived from the report of the Calcutta Municipality for the year 1888–89, shows in triennial periods for 12 years the average annual number of fever cases treated in the hospitals of Calcutta and the average annual mortality:—

Years.	Average Annual No. of Hospital Fever Cases.	Average Annual Mortality from Fever in Calcutta.
1877 to 1879 - -	41,670	5,344
1880 to 1882 - - -	31,835	3,726
1883 to 1885 -	27,497	3,630
1886 to 1888 - - -	24,704	3,291

The marked and continuous improvement, equally apparent in the hospital returns as it is in the health officers' statistics, is attributable to the completion of the drainage system, the consequent obliteration of the surface ditches, the increased dryness of the subsoil and the work done by an organised sewerage service. The figures are, moreover, borne out by common experience. The comparative immunity from fever enjoyed by residents in Calcutta as compared with residents in

1 p. 1855.

the suburbs and in the country is so notorious that persons suffering from fever frequently come to the city under medical advice as to a sanatorium.

Still, satisfactory as these results may appear at first sight, satisfactory as is the enormous increase in the value of landed property, and even more satisfactory the perceptible diminution in mortality, in truth, so much remains to be done to improve the sanitary condition of Calcutta that what has been done can only be pointed to as an encouragement to further exertion.

When all has been said, it must be admitted that the conditions of life in the metropolis of British India are still highly insalubrious. The cholera map of Calcutta is still simply a map in which the whole of the native town appears one mass of red dots indicating cholera deaths, and the inspection of this map with its record of more than 1,000 cannot fail to awaken a sense of how much remains to be done to improve sanitation. The Health Officer of the Corporation has lately called attention in the most prominent manner to the ventilation of the city by proper streets and squares and to the enforcement of proper building regulations as the most important sanitary measures which it remains to undertake. Pure air is as much a necessity for the public health as pure water, and the overcrowding of buildings not only impedes the circulation of air and disseminates disease along the poisonous alleys which divide house from house and harbour the germs of all disease, but it prevents the possibility of laying down efficient drainage and hinders and adds to the cost of scavenging. The ground of Calcutta is literally covered with houses without open space between them; and narrow streets, winding lanes, and zigzag passages afford complete obstacles to thorough ventilation. The statistics which the municipal reports furnish indicate the radical structural defects of Calcutta as a residential city. The roadway of the town extends over 184 miles, of which only 28 miles are roads of 32 feet in width and upwards; 103 miles vary in width from 9 to 31 feet, 17 miles are less than 9 feet in width, and 34 miles are sewered ditches, which, from the nature of the case, are often not more than 3 feet in width. The fine new street, known as the Central Road, which the Municipal Commissioners have, at great expense and with much public spirit, lately determined to cut through that overcrowded and overbuilt portion of the city, is a very important and valuable sanitary improvement. This road is now nearly complete. But it will exercise only a small influence in doing away with the evil of congested and unregulated buildings, unless streets from north to south and from south to north be constructed to meet it. The great structural defect which prevails, especially in Burra Bazaar, but also throughout the whole of the heart of Calcutta where the residents of the city dwell, is, and always has been, due to the toleration of too many houses and too many people on too limited a space, instead of forcing them to spread out on a wider area. The plan of construction of the city being radically defective, the supply of every other sanitary improvement is only palliative while that constitutional defect remains. It will never be possible to wipe away the reproach under which Calcutta labours as the home of cholera until the

present germ-laden air is as purified from contagion as is the filtered water now drunk by the people.

In conclusion, it must be added in justice to the Corporation of Calcutta, that the Municipal Commissioners are fully alive to the urgent necessity of energetically pursuing the course of sanitary improvement. Immense as are the difficulties of introducing sanitation into an Oriental city according to the western ideas of the present day, the problem in Calcutta is now in process of solution. Enormous sums have already been spent, and will continue to be spent; but it must be remembered that progress can only be gradual, and that the local authorities are hampered not only by financial considerations, but by the conservative habits of the people, which in the eyes of a sanitary reformer appear too often to be purely obstructive. It must be remembered, also, that the secret of overcoming this obstruction is to be found, not in attempting to coerce popular feeling by persistent condemnation, but in conciliation and sympathy.

The City of Rangoon.

BY

Major R. C. TEMPLE, Indian Staff Corps, President of the Rangoon Municipality.

Delegates.

J. THOMPSON, Esq., late Vice-President, Rangoon Municipal Commissioners.

H. M. MATHEWS, Esq., M.I.C.E., late Manager and Engineer-in-Chief, Burma State Railway, and a Municipal Commissioner, Rangoon.

O. D. CLARK, Esq., A.M.I.C.E., late Engineer to the Rangoon Municipal Commissioners.

S. G. JONES, Esq., late a Municipal Commissioner in Rangoon.

Rangoon, the capital of Burma, is situated 21 miles from the sea on the left bank of the Rangoon River, at its junction with the Panlang Creek, the Pazoondoung Creek, and the Pegu River, having surburbs on the right bank of the Rangoon River and on the left bank of the Pazoondoung Creek. As a village, Rangoon, under the name of Dagôn, was, according to the legend usually accepted by the Burmese, founded about 585 B.C. by two brothers, Poo and Ta-paw, who erected the Shway Dagôn Pagoda on a slight laterite ridge over some hairs from Buddha's head, which they had received from Buddha himself, and which they buried there. The village seems to have disappeared from history for long periods, but it was rebuilt and called Aramana by Poonnareeka, the King of Pegu, about 747 A.D. The Burmese occupied it in 1413 A.D. The town often afterwards changed hands and was frequently the scene of struggles between the Burmans and the Talaings, but eventually, in 1763, Alompra captured it for the Burmese, repaired the Pagoda, and named the town Yangoon or, as the Europeans call it, Rangoon, making it the seat of a Viceroy. The town was first occupied by the British from 1824 to 1827, when it reverted to the Burmese. It was again captured in 1852, from which date it has remained in British possession.

In 1852 Rangoon contained but a few offices and principal buildings, situated about one and a half miles from the river, what there was of a town being a collection of bamboo and plank houses and huts built on piles over a swamp partly flooded at spring tides. The spaces beneath the houses are described as being almost invariably receptacles for fæcal matter, dirt of all descriptions and stagnant water, from which, during the heat of the day, pestilential vapours constantly ascended.

It is almost needless to say that the English Rangoon of 1891 bears no resemblance to the Rangoon of 1852. Until 1874 municipal matters were in the hands of the Local Government, and in that year the first Municipal Committee took over the management of the town, which was

then without lights, a proper supply of water, or means of drainage. The exertions of the Government had been devoted to raising the centre of the town above tide level, providing land fit for building purposes, and making roads, bridges, culverts, and surface drains, but these had been only imperfectly, and to a limited extent, carried out before 1874.

Up to 1873 no attempt had been made to deal with sewage and, consequently, the land was honeycombed with cesspools, and the drinking water was little else than diluted sewage. In that year the Local Government ordered the cesspools to be closed, and introduced a system of night scavenging from house latrines and the removal of night-soil in carts to jetties on the river bank, where it was thrown into the river. This horrible system, which polluted the air of Rangoon throughout the night and made traffic in the streets a severe task, remained in force until last year, when it was superseded by the Shone system. The Shone system was adopted after severe criticism and mature deliberation as being really the only one by which the sewage of a flat, tide-locked town, like Rangoon, could be sanitarily dealt with, and, although the town was young and poor, it was thought that 175,000*l.*, the cost of the work, would be well spent if the system fulfilled its promises. Most exhaustive trials have been made of the works, which have now been in operation nearly two years, and the result has placed it beyond doubt that the favourable estimate originally formed of the Shone system has been completely justified by the result of its working. Rangoon is now the only city in the Indian Empire which can boast of a scientific system of drainage which fulfils all the requirements of sanitarians.

Unfortunately house-connexions in Rangoon are few in number, and until they are completed the full value of the perfect drainage system available in the town proper cannot be obtained, but this evil is being decreased daily and, to remedy it effectually, a new Municipal Act is proposed giving full and complete power to the municipal authorities to insist upon house-connexions. The works of the Shone sewage system include 6 miles of sewage mains, 22 miles of gravitating sewers, 4¾ miles of air mains and 44 Shone's ejectors.

The water used in Rangoon previous to 1878 was derived entirely from wells and tanks, and, in what is called the town proper, that is, the business and most crowded portion of the city, it was highly polluted. Cholera was always present and small-pox was endemic. In that year a main was laid from the Royal Lake in Dalhousie Park to Pazoondoung, where most of the mills and factories are situated and where a large coolie population was resident. Cholera was so frequent and disastrous in its consequences in this portion of Rangoon that this main was laid as a temporary measure, until a scheme for a proper water-supply could be carried out. The effect on the health of the neighbourhood supplied with good water was instantaneous; cholera practically disappeared and since then has never reached epidemic proportions.

In 1883 waterworks for the town proper, Pazoondoung and the shipping were completed, and now the Municipal Committee is about to carry out filtration works and to increase the supply of water, as the

city is growing so fast that the demand is already rapidly outstripping the supply.

Water is supplied to a large portion of Rangoon at present from a reservoir about five miles distant and near a village called Kokine. This reservoir, called the Victoria Lake, was made by forming embankments joining small hills between which streams ran in the rains, and from it the water is conveyed by iron mains to the Royal Lake, which thus forms a distributing reservoir. The cost of these works was 200,000*l.* High-pressure is obtained by the adoption of the Shone System. Twelve ejectors, each of 500 gallons capacity, have been fixed in an ejector-house near the Royal Lake, and to these the water gravitates. Compressed air has been laid on to the ejectors and a head of 62 feet is obtained by this inexpensive, clean and simple system. The works cost about 20,000*l.* and the expense of their maintenance is trifling, as the machinery that compresses air for the sewage works does the same work for the high-pressure waterworks, and no extra establishment, beyond a caretaker and some watchmen at the Ejector Station, are necessary. A few mill-owners are able to supply themselves with water from artesian wells, but the majority of them purchase water from the Municipality, and the railway and shipping take their supplies almost entirely from the Municipality.

The town proper of Rangoon, and one of the suburbs named Kemendine, are laid out on the block system, each block being 800 feet long by 860 feet wide, having 100 feet streets on all four sides and being intersected at every 115 feet of its width by streets, four of which are 30 feet wide, and one, in the centre of the block, being 50 feet wide. In the extensions of Rangoon to the east and west it has been decided to have no streets less than 50 feet wide.

The lighting of the town extends over 42 miles of roads, and the lighting of some portion of the remaining 50 miles is now suggested. Kerosine oil is the illuminant used.

Rangoon, as before remarked, formerly consisted almost entirely of plank or bamboo houses, and 15 years ago masonry buildings were few and far between. Of late, however, as wealth has increased, good masonry houses have more and more replaced insanitary wooden shanties, and powers will be given to the Municipal Commissioners in the proposed Municipal Act to prescribe the materials of which buildings may be constructed in any particular quarter.

Good slaughter-houses have been built at a cost of nearly 10,000*l.* to replace a wretched shed, which formerly did duty as an *abattoir*, and it is in contemplation to construct a cattle market and sheds and to keep animals a certain length of time before allowing them to be slaughtered.

Rangoon has excellent pleasure grounds: two large commons, which are available for military purposes and for races as well as for links and other public uses; a garden in charge of the Agri-Horticultural Society; an extremely pretty and well-kept garden in the Cantonments; a large square in the heart of the town proper; and, in addition to these, the Royal Lake and Dalhousie Park, which together form one of the

finest recreation grounds which any city can boast of, comprising as they do 295 acres of well-timbered park land and 160 acres of water.

The Civil General Hospital has accommodation for 300 patients, and last year 6,192 in-patients and 37,168 out-patients were treated in it. The Commissioners are about to spend 7,000*l.* in improving the sanitary and other arrangements of this hospital. The Military authorities have their own hospitals in the Cantonments. The Dufferin Institute for providing female medical aid to women has a branch and a small hospital in Rangoon, and endeavours are being made to raise sufficient money by subscription to build a good hospital for the purposes for which the Institute exists.

Contagious diseases (cholera and small-pox) are treated in separate hospitals built outside the most crowded part of the town. The buildings have bamboo mat walls, which answer every practical purpose, and which, being inexpensive, can be taken down and burnt when necessary. Unfortunately, in consequence of agitation in England, the Lock Hospital, which was of inestimable benefit, has been closed.

There are three Municipal, and eight private markets in Rangoon, but their condition admits of great improvement and is now receiving considerable attention at the hands of the Municipal authorities. The markets in Burma are really the most important retail business places in every town. In them nearly everything required by the public, whether food, drapery, clothing, hardware, stationery, medicine, perfumery, toilet requisites, or jewelry can be purchased; people meet there to buy, to sell, to gossip, to flirt, or to gather information; in fact, the English idea of a market conveys no correct impression of one in Burma.

Religious buildings and lands occupy an enormous area of Rangoon compared with its total size. Christians, Buddhists, Hindus, Mussalmans, Pônnâs, Parsis, and Jews all own lands and churches, pagodas, kyoungs, temples, mosques, or synagogues. The Buddhist kyoungs are, many of them, filthy, and a source of danger to the health of the city, but for reasons of policy a considerable amount of leniency has to be used in dealing with the religious buildings and customs of indigenous races in the British Empire in the East.

Burial grounds existed originally in every direction and were several years ago fixed in what was then the outskirts, and is now fast becoming the centre, of the city. A large necropolis is being prepared outside Rangoon, and most of the present graveyards, many of which are in a dangerously overcrowded state, will soon be closed. Cremation is not much practised in Rangoon unfortunately, although the population consists largely of Hindus.

The population of Rangoon was in 1812, 8,250; in 1826, 8,660; in 1863, 61,138; in 1872, 98,745; in 1881, 134,176, and in February 1891, 181,071. During the decade from 1881 to 1891 Rangoon passed through two years of great trade depression caused by the demoralisation consequent on the war in Upper Burma. The population undoubtedly decreased then, and the increase in the whole period is therefore all the more remarkable.

The aggregate death-rate of Rangoon is very high, being over 39 per mille. This is due to two causes. Firstly, the swampy nature of the outskirts of the town proper, which the poorer classes are compelled to use in their present state, as no other land is available. Secondly, there is a large annual Hindu immigration to the mills and factories from the lower orders from the Madras Presidency. The death-rate is found to be highest where the land is low, and among these Hindus. It is they that are the cause of the small-pox existing in the town and that contribute more than half the deaths from cholera and from bowel complaints. Strenuous efforts are being made to improve their lodgings and their present surroundings. A scheme for reclaiming the low lands of the town, to cost about 500,000*l.*, is now being considered in detail, and, when it is accomplished, say during the next decade, the death-rate of the town may be expected to be as low as that of the non-Hindu population, or about 26 per mille. That the death-rate need not be high owing to climate is proved by that of the Christians, who live in a cleanly manner and under sanitary conditions, and amongst whom the death-rate is less than 17 per mille.

Since compulsory vaccination was introduced in 1885, small-pox as an epidemic disease has disappeared from Rangoon, and what of it still occurs is invariably imported by the Madras coolies either from their own country or from the harvest fields of Burma. As showing the effects of compulsory vaccination it may be mentioned that in the six years ending with 1884, the average number of deaths per annum from small-pox was 353, while in the six years since 1884 the average number has been 39 per annum.

It is also interesting to note the effects of the introduction of a fairly pure water-supply into the town; firstly, in 1879, and secondly in 1883. In 1879 water was introduced into the suburbs of Pazoondoung, and the average number of deaths from cholera, which in the three previous years had been 231, was reduced in the next three years to 65. In 1883 water was laid on to the town proper, and the average number of deaths from cholera was reduced from 155 per annum in the six previous years to 59 per annum in the six succeeding years.

The City of Auckland, New Zealand.

BY

P. A. PHILIP, J.P., Town Clerk.

The City of Auckland, New Zealand, is situated on the southern shore of the Waitemata harbour, possessing two docks, one of which—the largest in the southern hemisphere, being 500 feet long, 80 feet wide, with 35 feet of water on sill at high water, and having a wharf accommodation of nearly 3,000 feet—is ample for vessels of from 100 to 5,000 tons.

The area of the city, which in 1870 was 663 acres, in 1891 is 1,762 acres.

The population in 1872 was 12,745, and in 1891, 29,000.

The death rate in 1870 was 10·12, and in 1891, 1·17 per cent.

The drainage work done comprises 45 miles, inclusive of sewers and pipes, at an outlay of over 50,000*l.*

The city is supplied with a comfortable tramway service (horse); at present the length is about 12 miles.

The water supply, provided at a cost of about 125,000*l.*, is ample and of the purest character; it is drawn from the western springs, about three miles from the city, and is pumped into four large reservoirs on the high levels of the city, and thence supplied by gravitation, the pressure being minimum 100 lbs. to the square inch, maximum 140 lbs. ditto. There are about 80 miles of mains, and the number of service supplies is 2,500, the supply being ample for street watering, fire extinction, and ornamental fountains, drinking troughs, public lavatories, etc.

The total number of streets and roads in 1870 was 122, in 1981 it is 276, and their length is 44 miles.

The Corporation have established swimming baths, both fresh water and salt water, with ample accommodation for both sexes. The fresh water bath, to which salt water is supplied during the summer months, is unequalled in the Colonies. These baths have been provided at a cost of about 9,000*l.*

The city possesses two small but charming parks in the centre of the town, of an area of about 13 acres each, and a Domain, with its native shrubbery (intersected with good roads and paths), of nearly 200 acres close to the city; while the junctions of various streets are all fenced and planted with trees and shrubs, and several of the streets are planted with plane, oak, poplar, and other trees. The Domain comprises one of the largest and best cricket and football grounds in the Colonies. A commodious bowling green and several lawn tennis clubs exist.

The city possesses a handsome free library, with newspaper, magazine, and reference departments; also a lending branch with upwards of 20,000 volumes and 5,000 manuscripts, plans, etc. This library is open to the public daily, and on Sundays from 2 to 10 p.m. For this library the citizens are much indebted to the munificence of Sir G. Grey, and to that of the late Mr. Edward Costley who left 13,000*l.*, the interest upon which is devoted to the purchase of new books.

The art gallery established by the Corporation in the municipal buildings possesses, owing to the munificence of Sir George Grey and the late Mr. J. T. Mackelvie, one of the finest collections of curios, paintings, articles of vertu, etc. in the southern hemisphere.

The citizens are also indebted to the late Mr. Elam, who left 10,000*l.* for the establishment of a school of art, free of cost to pupils, which, under the direction of Mr. Payton at the municipal buildings, is largely attended. The Art Society have a public meeting and reading room, and hold their sittings in the municipal buildings.

The city possesses ample abattoirs, well situated, with good drainage and ample water supply.

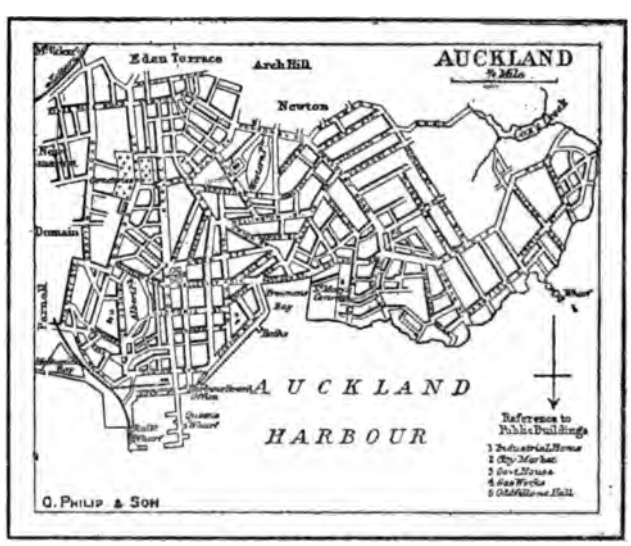
Cemetery provision for the city is well situated about nine miles from town by rail; it comprises an area of 188 acres. Interments, except for blood relations, are no longer permitted in the cemeteries existing within the city.

The city possesses several very large public schools, grammar and high school, and University classes for both sexes. Elementary education is compulsory and unsectarian. There are also several private schools. The number of children attending the public schools is about 8,000.

The city possesses a large well-situated hospital; besides commodious new buildings for old men's and women's refuges, for which the citizens are indebted to the late Mr. Edward Costley, who left 84,000*l.* to be divided amongst the various city institutions. The hospital, etc. is controlled by the Hospital and Charitable Aid Board.

There is a good museum, containing a splendid collection, open every day, Sunday included.

Viewed from sea or land the scenery of Auckland is considered most beautiful, and the city possesses one of the finest harbours in the world.



The Colony of South Australia.

BY

THOMAS BORTHWICK, M.D. (Edin.), Health Officer for Kensington and Norwood, &c., Delegate from the Colony to the Congress.

A short account of the hygiene and sanitary conditions of South Australia will be of interest, inasmuch as it shows these conditions as they exist in a new country, and affords a basis of comparison with older communities.

South Australia comprises a section of the Australian continent from north to south. The western boundary is formed by the colony of West Australia, while on its east lie the colonies of Queensland, New South Wales, and Victoria. Its northern limit is exceeded only a few miles by the most northerly point of Queensland, and a large part of Victoria lies further south than its southern boundary; hence, it is evident that South Australia is a misnomer. It has been proposed to change the name to Central Australia, but this term cannot correctly be applied to a country which extends from north to south. Perhaps the proper designation would be Middle Australia, or, to use one word, Mes-Australia.

The northern half of this middle section of the continent is known as *the Northern Territory*—its acquisition dating from 1863, and as it lies north of the 26th parallel of latitude, and is, consequently, principally within the tropics, it will not be included in this account.

South Australia proper is bounded on the east and west by the colonies already mentioned, the eastern boundary being the 141st and the western the 125th degree of longitude. The 26th parallel of south latitude forms its northern boundary, and it is bounded on the south by the Southern Ocean, the coast-line extending from the 38th to the 31st 45′ parallel of south latitude, a distance of over 2,000 miles. It comprises an area of 380,070 square miles.

Physical features.—The southern coast-line is broken by two large bays, the one extending 90 miles, the other 200 miles inland. They overlap to some extent, and between the two lies a tongue of land which has been compared in configuration to Italy. Various other bays exist, but they are not sufficiently large to affect the configuration of the country. Still, the two gulfs mentioned expose a large extent of the colony to the influence of the sea.

Parallel to these gulfs lies a range of mountains, which attain an elevation of 2,334 feet above sea level. The average breadth of the range is about 30 miles, and as it proceeds northwards it separates into several smaller parallel ranges, whose highest point is 3,000 feet. These end in a series of hills about 29° 31′ south latitude. Other smaller ranges are scattered over the colony, but they are of little importance.

The principal range divides the river system of the colony.

On its eastern side are several small rivers, which have their origin in the mountains, and vary considerably in size and volume. On the western side of the range is the only large river, namely, the Murray; it rises in New South Wales, but has a course of 500 miles through South Australia, being navigable all that distance, and finds its outlet into the sea through a series of lakes. In the interior of the colony are to be found watercourses of great length, which carry the flood-waters of south-west Queensland, sometimes finding their way into the lakes, sometimes losing themselves in the plains. In exceptionally wet seasons, the country is sometimes inundated for hundreds of miles, but these watercourses are frequently dry for long periods.

The lakes of the colony include those mentioned, the lakes at the mouth of the River Murray, and the lakes in the interior. The latter are fed by the flood-waters, but are often almost dry and represented by basins of mud and salt. In the south-east are some volcanic lakes occupying the craters of extinct volcanoes. It is thus evident that the lake system has no hygienic value whatever.

The geological formation of the country may be shortly described as follows:—"The rocks of the mountain ranges belong to the oldest of "the sedimentary series, and outcrops of the same formation are to be "seen in many places rising like islands above the surrounding and "newer strata. Much of the interior must be classed as secondary, "including the great stony downs and tablelands, where sandstone, "conglomerate, quartzite, gypsums, clays, and limestone, in some places "highly fossiliferous, are met with. North of Lake Torrens, extending "from the Nullarbor plains to the eastern boundary, is a broad expanse "of tertiary and post tertiary deposits, interrupted by plutonic rocks "and the primaries that have been referred to. In some places the "tertiaries are 300 feet in thickness, and seem to indicate a period of "slow submergence when beds of sandstone and limestone rich in "marine fossils were formed. Plutonic rocks occur in several localities, "and in the extreme south-east is a series of extinct volcanoes."

The general nature of the surface of the country may, to some extent, be inferred from the preceding description. The mountain ranges are, on the whole, well wooded with various kinds of eucalypti, and have well grassed valleys interspersed. Fertile plains lie between the gulfs and the ranges, while to the eastward is a vast extent of smaller scrub and salt-bush. North of the gulf is an extensive shallow depression containing the lakes and plains of stony desert. Towards West Australia, as far as has been explored, the country seems to consist largely of dense scrub and sandhills, but towards Queensland, and in various other parts of the interior, there is some good pastoral country. Among the interesting features of the interior may be mentioned the "Mound Springs," conical hills from which water flows, occurring singly or in groups; they are natural artesian wells, some of them being warm, others impregnated with minerals, and the natives are said to use them for medical purposes.

Meteorological conditions.—For practical purposes, the year may be divided into two seasons, summer, extending from October to March,

and winter, from April to September (inclusive). The summer months may be described as hot and dry, the winter months as cold and wet. *The temperature* is highest during December, January, February, and March, the mean in the shade exceeding 70° F. It occasionally exceeds 100° F. during those months, the highest recorded temperature being 116·3° F. In March the heat is of shorter duration and the nights are cooler. The same may be said of November, while October, with a mean of about 62° F., has very few hot days, and might almost be classed as a winter month. After March the temperature falls rapidly, and reaches its lowest point in June, July, and August, the mean being about 53° F. The lowest recorded temperature (at Adelaide) is 32·3° F. During April and the early part of May the mean is about 60° F., and the rains which now fall, along with the retained heat in the soil, cause a rapid growth of vegetation, which is only interrupted by the cold of winter, and starts afresh towards the end of August.

In regard to the heat of summer, it is by no means unbearable, and rarely oppressive, except when a hot wind, sometimes laden with dust, blows from the interior; for the extreme dryness of the air, as shown by the wet-bulb registering as much as 67° F., or 21° below the dry-bulb, to a large extent compensates for the heat, and although rain rarely falls, there is frequently cold cloudy weather.

The rainfall is greatest in the months of May, June, July, and August, averaging about 2½ inches; there has been recorded a maximum of 7·8 in June. The average number of wet days is 13 in May, 14 in June, 16 in July, and 16 in August.

The average rainfall of December, January, February, and March is under 1 inch, and frequently during those months little or no rain falls. November averages just over 1 inch, and October, September, and April nearly 2 inches. The average annual rainfall (for 51 years, 1839–89) is 21·114 inches, it has been as high as 30·8, and as low as 13·4 inches. These figures, as well as the preceding, refer to Adelaide, but there is considerable variation throughout the colony. Thus, on the Mount Lofty Ranges it is as much as 40, in the south-east from 30 to 22, along the Murray from 18 to 12, on Yorke Peninsula 13, and at the head of Spencer Gulf about 9 inches. Probably for 100 miles north of Adelaide it averages nearly 21 inches. The interior of the colony is occasionally visited by heavy rains, and when these occur, as they usually do in summer, they are the tropical rains of the northern coast of the continent, which have been carried beyond the usual limit by a strong north-west monsoon. This, however, is a rare occurrence, and the interior is frequently exposed to prolonged drought. Heavy winter rains may fall in the north when the centre of the cyclonic disturbance passes (in its course from west to east) well to the north of Adelaide, but, as a rule, it follows a line parallel to the coast and passes to the south of Adelaide.

The changes in the *barometic pressure* proceed from west to east across the continent, being noted in Western Australia from two to four days before reaching Adelaide. It is highest during the winter

months, with a mean of 30·127 inches, while the mean of summer is 29·990. The highest recorded reading is 30·553, the lowest 29·096 inches. The fluctuations are greatest during winter, the greatest range in any one month being 1·379, and the least 0·474.

The winds, during the summer, tend towards the heated interior of the continent, and south winds predominate, while, during the winter, north and north-east winds prevail. Throughout the whole year the prevailing winds of the interior are south-east, but during summer they are influenced by the north-west monsoon, which, when strong enough, may sweep south through the colony as the hot wind previously referred to. It very rarely carries the rains along with it beyond the McDonnell Ranges of the Northern Territory; but it has been already pointed out that this does occur. Thus, it follows, that with a strong monsoon and tropical rains in the north, there is a hot summer with hot winds further south, but when the monsoon is weak and the interior dry, the polar currents from the south-east prevail, and there is consequently a cool summer in the southern portions of the colony.

The highest *temperature in the sun* by the lampblack bulb is in January, about 160° F.; the lowest, in July, 120° F.

The mean *sunshine* is from 7·5 to 10·5 hours per diem in the summer months, and from 3·7 to 8 in the winter. In regard to the *state of the sky*, the summer months have from 15 to 20 almost wholly clear days, the winter from 10 to 11. Taking the whole sky as 10, the mean amount of cloud in each month is as follows:—January, 4; February, 3; March, 4; April, 4; May, 6; June, 6; July, 6; August, 6; September, 5; October, 4½; November, 5; December, 4.

The relative humidity is from 45 to 50 in the summer, and from 50 to 79 in the winter months.

The amount *of evaporation* from the surface is greatest in January, when it varies from 9 to 11 inches; and least in June, from 1½ to 2 inches. During the three hottest months it averages ⅓ inch per day, and when a hot wind is blowing it may be as much as $\frac{6}{10}$ inch; while in the coldest months it averages about $\frac{7}{100}$ inch per day.

The climate as a whole is salubrious. The cold of winter is not excessive, and the heat of summer is compensated for by the dryness of the air, which permits both work and play to be undertaken with impunity. Almost every variety of climate can be obtained. The cold wet winter of the Adelaide plains can be exchanged for the drier parts of the north, while the summer heat of the plains may be escaped at the seaside or in the hills, where the difference of temperature may be as much as 20° during the day, and still more at night. But throughout the colony generally, the clearness of the atmosphere and the unclouded sky render a large portion of the year exceedingly pleasant.

General progress of the Colony.—The first settlers arrived towards the end of 1836. After an interval of a little over half a century, we find (31st December 1889) a population of 319,166 that has pushed its way for hundreds of miles into the interior. Over 9,000,000 of miles have been alienated, and nearly 3,000,000 brought under cultivation.

There are 170,000 horses, 324,000 cattle, and 6,400,000 sheep in the colony. The staple produce exported during the year amounted to nearly 3,000,000*l.*; while the total export and import trade together exceeded 14,000,000*l.* There are about 14,000 miles of main roads, apart from district roads; and 1,756 miles of railway have been constructed, extending to nearly the centre of the continent on the one hand, and communicating with Melbourne on the other, while a branch extends to the Barrier district of New South Wales. There are 11,677 miles of telegraph and telephone wires; and, perhaps, there is no better example of the energy of this handful of people than their accomplishment of the great work of carrying the telegraph right across the continent, a distance of 2,000 miles, when it was a veritable "*terra incognita.*" This trans-continental wire meets the cable of the Eastern Extension Telegraph Company at Port Darwin, and thus places Australia in direct communication with England.

Adelaide, the capital of the colony, has a population of 45,000, or including the suburban towns of over 90,000. It is situated on the plains about midway between the Mount Lofty Ranges and the gulf on a rising piece of ground which is exceedingly advantageous for drainage purposes. It is generally admitted that a more admirable site could not have been selected. The city is about a mile square, and the streets, which are wide and well made, run east and west and north and south. It is surrounded by a belt of land about half a mile wide, called the Park Lands, which are planted with trees and reserved for public purposes. Within the city itself are several large squares laid out with flowers and shrubs, while the Botanic Gardens and Park, an extensive domain, are well known for their experimental and ornamental value. Separating north from south Adelaide is the Torrens river, which formerly in summer consisted of a chain of offensive waterholes, but has now been converted by the construction of a dam into a fine lake, much used for boating purposes. Works of a purely sanitary nature will be referred to again.

The suburban towns combined have a population which exceeds that of Adelaide, and varies individually from 1,000 up to 11,000. They are spread over a considerable area, and, being of more recent date, are not so advanced in public works as the city. The other corporate towns are scattered throughout the colony, and may be classed as seaport towns, mining towns, and agricultural towns (that is, towns forming the centres of agricultural districts). Their populations vary from 700 to 9,000, and, combined, amount to 24,000. They are all well laid out, but have various sanitary drawbacks to contend with, as will appear later.

Sanitary progress.—In considering the sanitary condition of a new country, it must be remembered that a great deal of energy is necessarily expended in bringing nature under subjection. The fact of living is so real that the manner of living is for the time being of secondary importance. Accordingly it is not altogether to be wondered at if we find sanitary requirements sadly neglected in the early days of the colony's history. Previous to 1873 there was no special legislation

in the direction of conserving the public health. In the various municipal Acts which were passed before that date the corporations had power "to adopt all such measures as they may deem necessary "for the cleansing of the said city and the preservation of the public "health, and for the prevention and suppression of nuisances." This seems comprehensive enough; but the energy of the corporations was all spent in other directions, and the sanitary result was feeble indeed. As far as the colony outside the corporate towns was concerned, there was no provision whatever made in regard to the public health, except that the Governor in Council might make an order in case of emergency. Thus, it is apparent how a mass of sanitary arrears was accumulating, and was being debited to the public health account of the colony. To take Adelaide itself as an example, the drainage was effected by open channels in the streets, the cesspits were leaky, the ground was soaked with filth, and in fact it was described as "a city of stinks from one end to the other." In regard to the rest of the colony, official reports show that the following conditions existed in every direction, namely: defective drainage, imperfect construction of cesspits, tainted water supply, and inefficient (if any) scavenging arrangements. While the condition of the city of Adelaide has been remedied, that of the greater part of the colony has unfortunately been but little improved.

In 1873 the "Public Health Act" was passed, and in 1876 it was amended; they constitute practically one Act. A Central Board of Health was created, and also local boards with certain powers. The latter boards are constituted by the councils (for the time being) of all corporate towns and districts; and this constitution is unfortunate in various ways for sanitary progress. On the other hand, the Central Board is hampered by a want of practical sympathy on the part of the Government; and these circumstances, along with the permissive and tentative nature of the Acts themselves, do not conduce to good work being done. Thus, a medical officer of health is appointed by the local boards when the Central Board thinks the circumstances require it, and this has been done in the case of the principal corporate towns; but the officer is so poorly paid, and in fact discouraged to act with anything like zeal, that the appointment is in the majority of instances a sinecure. Still, on the whole, these Acts have been productive of some good results, as may be inferred from Table VIII. in the Appendix.

They were again amended in 1884 by the "Public Health Acts Amendment Act," which gives power to the Government to proclaim any contagious or infectious disease, thereby rendering it compulsory on the medical attendant to notify every case of such disease to the Central Board of Health, a fee of 5*s*. being allowed. Hitherto, only small-pox, cholera, and yellow fever have been proclaimed; and as these diseases are unknown in the colony, the Act is to all intents and purposes a dead letter so far as notification of infectious diseases in the colony is concerned, and is only useful in so far as it assists the operation of the Quarantine Act. Still, its application can be extended, and there is evidence of a public feeling growing in that direction, so

that before long we may hope to see notification of all infectious diseases made compulsory. It may be mentioned, that some corporate towns adopted the system of compulsory notification in 1886 by means of a byelaw placing the onus of notification on the householder; and while it has worked very well, both from a practical and educational point of view, it must be admitted that the dual system is the more satisfactory.

Among the special sanitary difficulties that have to be grappled with is the difficulty of obtaining a pure water supply in many parts of the colony. In some places water itself is scarce, while in others it has to be procured from tainted sources; and the greatest care has to be exercised in preventing contamination. In most of the towns the Government has constructed waterworks, the water being obtained in many instances from creeks and springs by pumping and conducted into tanks and reservoirs. The city of Adelaide and the suburbs are fortunate in having an exceptionally good and abundant water supply, which was introduced about 1857. A short sketch of this and of the drainage system of Adelaide may be of interest as representing the chief sanitary works of the colony, and works which have undoubtedly contributed to the improvement of the public health, as may be seen from Table IX. in the Appendix.

"The source of the water supply is the River Torrens where it issues from the Mount Lofty Ranges; and the catchment area equals about 150 square miles, consisting of very hilly ranges of a slate and sandstone formation, covered with poor soil and sparsely timbered. The flow of the river is constant but variable, according to the season of the year. The headworks consist of a heavy masonry weir, constructed in a narrow gorge. No filtering appliances are used, as the water after the first winter floods have passed over the weir (and been rejected) becomes clear and fit for use. The intake is regulated by a sluice-valve, which can be opened and closed in two minutes; and no bye-washes are needed. An open aqueduct about 3¾ miles long conducts the water to two reservoirs, whence it is distributed to the city. The reservoirs contain, respectively, 140,500,000 and 886,915,752 gallons; and the consumption fluctuates from 1,750,000 gallons in winter to 6,000,000 gallons in summer, per diem. The service is high pressure with constant supply, and for domestic use unstinted."

The following analysis of the water is by Prof. Rennie of the Adelaide University:—

Total solids	45·00	per 100,000	parts.
Chlorine	13·25	"	"
Free ammonia	·004	"	"
Albuminoid ammonia	·030	"	"
Nitrates and nitrites	Nil.		
Oxygen consumed (Tidy's process)	·180	"	"

He points out that the albuminoid ammonia is very high, and that the oxygen consumed is greater than it ought to be; but that from the

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comparatively small quantity of free ammonia and the absence of nitrates and nitrites, the impurity is more of vegetable than animal origin.

The drainage system, with which is connected the sewage farm, was begun in 1882, and was finished, as far as the city is concerned, in 1884, but since that date it has continued to be extended to the various suburbs. "The main sewers and branch house-drains from "the sewer to the building line of the streets are laid by the Govern-"ment, while the house-drains inside that line are laid at the owner's "cost under the immediate supervision of the Hydraulic Department. "At the boundary of the premises a boundary trap was fixed, and the "arrangement of all house-drains, traps, vents, and sinks, is designed "by the department after conferring with the owner, so that there is "uniformity of design throughout the whole system." Originally, street grids were placed every 50 feet along the street sewer; but these were found to be vents for the escape of sewer gas, and such intolerable nuisances, that they were finally nearly all closed, and ventilating pipes or shafts fixed wherever practicable. At the same time, the boundary traps were removed back close to the house and a ventilating pipe was placed on the sewer side of the trap. This is the only special difficulty which has occurred in connexion with the drainage system. The smell proceeding from the street grids was so offensive that people passing felt sick, and sometimes vomited. It was described as sickening and offensive, "not like that of fœcal matter so much as it was of decomposing cabbage water and rotten onions." The smell was confined to the street grids, and was not noticed in the course of the house-drains; hence it was apparent that the boundary traps were working effectively, but that the grids were ventilating the wrong way. It was considered probable that the smell was the result of the accumulation of gas between the street sewer and the boundary trap, where no provision had been made for ventilation; and, certainly, when this defect was remedied there was a complete disappearance of the nuisance. Only one or two grids were left open in each street; and, according to the testimony of the hydraulic engineer, there is a steady current through the sewers, and the air in them is much improved. The sewers are made up of the following lengths and sizes:—

Open concrete channel - - -	·32	miles.
Covered „ „ - - -	1·31	„
Egg-shaped sewers, 3 feet 4 inches by 5 feet - -	1·62	„
„ „ 2 feet 8 inches by 4 feet - -	·67	„
„ „ 2 feet 4 inches by 3 feet 6 inches -	·93	„
Wrought-iron tube, 42 inches diameter -	·04	„

Pipe sewers,	earthenware,	24	inches	diameter		·57	parts.
„	cast-iron,	24	„	„	-	·27	„
„	earthenware,	21	„	„	-	·38	„
„	cast-iron,	21	„	„	-	·19	„
„	earthenware,	18	„	„	-	1·11	„
„	„	15	„	„	-	2·76	„
„	„	12	„	„	-	7·57	„
„	„	9	„	„		16·55	„
„	„	6	„		-	37·71	„
	Total			-	-	70·00	miles.

"The open concrete channel carries the sewage to the sewage farm, which is situated about four miles from the city. Adelaide being 154 feet and the sewage farm 40 feet above the level of the sea, the force of gravitation is sufficient to cause a rapid flow of the sewage. The farm comprises 470 acres, and the soil varies from a stiff clay to a sandy loam. It is divided into 21 paddocks of from 8 to 25 acres in size, and water has been laid on to each, for the use of cattle depasturing in them. The farm is worked on the broad irrigation principle, combined in the winter months with intermittent downward filtration. The filter beds are thoroughly under-drained, and work most effectually, the effluent carried off therefrom being perfectly clear. The sewage is first strained by revolving strainers, and is then conducted over the farm by means of cement carriers and tarred wooden troughing. The production of the land treated with sewage has been extraordinary, the crops grown consisting of lucern, Italian rye grass, mangolds, sorghum, wheat (for hay), barley, vines, and wattles. A large number of cattle, horses, sheep, and pigs are also kept on the farm. It was at first intended to carry on dairy-farming, but this had to be abandoned, on account of the popular prejudice against the produce. Still, however, the green crops are cut and sold to dairymen outside, and with no bad results. For the two years ending June 30th, 1889, there has been a profit over the working expenses, not including interest on working capital or rent for land."

Referring to the prejudice against the dairy produce of the farm, it may be mentioned that there were no actual grounds for it. As regards the effect of the farm on the public health, a nuisance arising from the smell of the sewage is very rare; and, although suspicion has at times been raised as to the cause of outbreaks of enteric fever, when investigated they have been shown to have an origin from other sources. In one instance, a man employed on the farm was attacked with enteric fever; and, as he was in the habit of drinking the effluent water rather than take the trouble to go to the taps, it is impossible to say how far this was associated with the disease; but it raises the interesting question of the destination of germs in sewage farms. The following is the result of the analysis of two samples of effluent water by Professor Rennie; the first sample was taken after heavy rains on the

two previous days, the second after scarcely any rain for two or three days previously. The figures express parts per 100,000 :—

Sample.	Free Ammonia.	Albuminoid Ammonia.	Nitrogen as Nitrates and Nitrites.	Oxygen consumed.	Total Solids.
1	0·80	0·14	0·36	0·25	177·64
2	0·41	0·05	1·18	0·18	247·8

He points out that as sewage usually contains from 4·5 to 5·5 parts of free ammonia per 100,000, and either no nitrogen as nitrates and nitrites, or mere traces, the above serve to show that though the water is very impure, a very considerable purification has been effected. The presence of nitrogen as nitrates and nitrites shows that a great part of the nitrogenous matter has been oxidised and to that extent destroyed. In the second sample, when the water was flowing slowly, the presence of less ammonia, but more nitrogen as nitrates and nitrites (as compared with the first sample) indicates a more effective oxidation, and this is borne out by the smaller amount of oxygen consumed.

The effect of these works on the sanitary condition of Adelaide is apparent not only in the outward and visible aspect of the city, but in the mortality. In regard to its appearance, from being "a city of stinks" it has come to be looked upon as the cleanest city in the southern hemisphere, while in regard to the mortality, Table IX. shows the various death-rates which bear upon the point.

Other tables are appended in illustration of the preceding remarks and of facts which have of necessity been left out in this short paper.

It may be added, that among various official papers utilised in compiling the foregoing statements, the annual reports of the Government Astronomer and of the Registrar-General have been chiefly drawn upon.

APPENDIX.

TABLE I.

POPULATION at the TIME of each CENSUS.

Date of Enumeration.	Population.			Increase on Previous Census.	
	Males.	Females.	Total.	Numerical.	Per Cent.
1844—Feb. 26 - -	9,526	7,840	17,366	—	—
1846—Feb. 26 - -	12,670	9,720	22,390	5,024	28·8
1851—Jan. 1 - -	35,302	28,398	63,700	41,310	184·5
1855—Mar. 31 - -	43,720	42,101	85,821	22,121	34·7
1861—Apr. 8 - -	65,048	61,782	126,830	41,009	47·7
1866—Mar. 26 - -	85,334	78,118	163,452	36,622	28·8
1871—Apr. 2 - -	95,408	90,218	185,626	22,174	13·5
1876—Mar. 26 - -	110,491	102,780	213,271	27,645	14·0
1881—Apr. 3 - -	149,530	130,335	279,865	66,594	31·2

TABLE II.

INFLUENCE of IMMIGRATION and EMIGRATION on POPULATION.

Periods.	Excess of		Proportion of Natural Increase to 100 of Migration Increase.
	Immigration over Emigration.	Births over Deaths.	
1836-89 - -	128,412	186,608	145
1836-65 - - -	52,290	52,893	101
1866-89 - - -	76,121	133,715	175

TABLE III.

AGE CONSTITUTION of POPULATION in 1881.

Per Cent.	0—5.	5—10.	10—15.	15—20.	20—25.	25—35.	35—45.	45—55.	55—65.	65—75.	75—
Total - - -	14·8	12·4	11·5	10·6	10·9	15·6	10·6	6·9	3·9	1·7	·56
Males - -	7·5	6·2	5·7	5·2	6·0	9·2	6·0	3·7	2·1	·9	·29
Females - -	7·3	6·1	5·7	5·3	4·9	6·3	4·5	3·1	1·7	·8	·27

TABLE IV.

URBAN and RURAL DISTRIBUTION of POPULATION in 1881.

(*Urban includes population of all corporate towns.*)

—	Per Cent.
Urban population - -	31·2
Rural „ - - -	68·7

TABLE V.

BIRTH, MARRIAGE, and DEATH RATES.

Year.	Birth Rate.	Marriage Rate.	Death Rate.
1844–50 - - -	36·0	7·4	14·2
1851–60 - - -	43·5	9·9	15·5
1861–70 - - -	42·9	8·3	15·5
1871–75 - - -	37·6	7·6	15·8
1876–80 - - -	33·2	8·8	14·9
1881 - - -	38·5	8·3	14·4
1882 - - -	38·0	8·8	15·4
1883 - - -	38·0	8·6	15·0
1884 - - -	39·0	8·4	15·7
1885 - - -	39·0	7·9	12·9
1886 - - -	36·5	6·4	13·8
1887 - - -	35·0	6·4	12·7
1888 - - -	33·8	6·7	12·0
1889 - - -	32·7	6·5	11·1

TABLE VI.

INFANTILE MORTALITY.

Year.*	Infantile Mortality per 1,000 Births.
1885 - - -	113
1886 - - -	126
1887 - - -	111
1888 - - -	96
1889 - - -	94

* Previous to 1885 data are unreliable in this respect.

TABLE VII.

DEATH RATES of AGE GROUPS in 1889.

Mean Population.	All Ages.	0–5.	5–10.	10–15.	15–20.	20–25.	25–35.	35–45.	45–55.	55–65.	65–75.	75–
315·402	11·1	28·9	2·9	1·8	3·2	3·8	5·6	6·9	12·3	24·5	60·3	160·2

Table VIII.

Mortality in Relation to Sanitation, taking 1874–76 as a Central Period, which embraces the passing of the Public Health Acts. During this period there occurred severe Epidemics of Scarlet Fever and Measles.

—	1858–65.	1866–73.	1873–76.	1877–82.	1883–89.
Total Death Rate -	16·37	14·75	17·89	14·68	13·37
Measles - - -	·214	·095	·598	·056	·076
Scarlet Fever - -	·801	·073	1·263	·229	·037
Influenza - - -	·069	·032	·031	·010	·008
Whooping Cough -	·296	·310	·031	·173	·190
Diphtheria - -	·584	·514	·312	·260	·307
Croup - - -	·425	·300	·264	·257	·193
*Enteric Fever - -	·663	·629	·597	·423	·467
Diarrhœal Diseases -	1·823	1·528	1·542	1·381	1·169
Phthisis - - -	·946	·946	·983	1·024	1·066

* Along with enteric fever are included simple, continued, and remittent fevers, which terms certainly are synonymous with enteric in this colony.

Table IX. (α).

Mortality of Adelaide in Relation to the Deep Drainage.

Note.—The deep drainage system was inaugurated in 1882, and completed about the end of 1884, so that the period 1882-84 forms an intermediate period for purposes of comparison.

—	1877–81.	1882–84.	1885–88.
Colony - - - - -	14·5	15·3	12·5
*Adelaide - - -	21·5	21·1	15·8
*Colony minus Adelaide - -	13·0	14·3	11·9

* Deaths in public institutions of persons not usually resident in the city are excluded from Adelaide and added to Colony minus Adelaide.

Table IX. (β).

—	1879–81.		1882–84.		1885–89.	
	*Adelaide.	Colony minus Adelaide.	*Adelaide.	Colony minus Adelaide.	*Adelaide.	Colony minus Adelaide.
Total Death Rate -	24·5	12·4	24·5	13·3	19·0	11·4
Diphtheria - -	·41	·26	·34	·23	·30	·32
Croup - - -	·31	·31	·43	·30	·10	·14
†Enteric Fever -	·76	·28	1·11	·43	·73	·39
Diarrhœal Diseases	1·84	1·13	2·18	1·46	1·21	·96
Phthisis - - -	2·84	·70	2·58	·84	2·56	·81

* Including all deaths in public institutions.
† Enteric fever includes simple, continued, and remittent fevers.

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